IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF PENNSYLVANIA

AQUAPAW LLC, Plaintiff, v. ALLNICE, *et al*., Defendants.	Civil Action No. **FILED UNDER SEAL**

DECLARATION OF STANLEY D. FERENCE III IN SUPPORT OF PLAINTIFFS' *EX PARTE* APPLICATION FOR ENTRY OF A TEMPORARY RESTRAINING ORDER AND PRELIMINARY INJUNCTION

I, STANLEY D. FERENCE III, hereby declare as follows:

1. I am an attorney with the law firm of Ference & Associates LLC ("the Ference Firm"), located at 409 Broad Street, Pittsburgh, Pennsylvania 15143 and represent Plaintiff in the above-referenced action.

2. I make and submit this declaration in support of Plaintiff's *ex parte* application for the following: 1) a temporary restraining order; an order restraining assets and Merchant Storefronts; 3) an order to show cause why a preliminary injunction should not issue; and 4) an order authorizing expedited discovery against the above-named Defendants, Third Party Service Providers, and Financial Institutions, in light of Defendants' intentional and willful offerings for sale and/or sales of Infringing Products ("Application").

Document Authentication

3. According to the Fiscal Year 2018 U.S. Customs and Border Protection ("CBP") Intellectual Property Seizure Statistics Report, e-commerce sales have resulted in a sharp increase in the shipment of unauthorized products into the United States. Over 90% of all CBP intellectual property seizures were smaller international mail and express shipments (as opposed to large shipping containers). *Id.* Over 85% of CBP seizures originated from mainland China and Hong Kong. *Id*. A true and correct copy of an excerpt of this report is attached hereto as **Exhibit 1**.

4. According to a report released by the U.S. Chamber of Commerce Global Intellectual Property Center (GIPC) titled Measuring the Magnitude of Global Counterfeiting, at least 86 percent of all global counterfeit products originate in Chinese and Hong Kong markets. A true and correct copy of an article released by GIPC summarizing the report is attached hereto as Exhibit legitimate businesses and broader economic losses, including lost tax revenue. A true and correct copy of this report is attached hereto as **Exhibit 2**.

5. A February 2017 report commissioned by Business Action to Stop Counterfeiting and Piracy (BASCAP) and the International Trademark Association (INTA) entitled The Economic Impacts of Counterfeiting and Piracy included findings that counterfeit and pirated products account for billions in economic losses, resulting in tens of thousands of lost jobs for legitimate businesses and broader economic losses, including lost tax revenue. A true and correct copy of this report is attached hereto as **Exhibit 3**.

Rule 65(b) Certifications

6. In my experience policing the Plaintiff's products, and based upon my review of lawsuits filed by other brand owners, sellers of counterfeit and/or infringing products, particularly those sellers whose product listings are removed, merely change the description or photograph and then re-post the listing for the products on their respective Merchant Storefront[1] or modify or create a new User Account[2] and/or Merchant Storefront and proceed to sell the same product again. Likewise, these counterfeit sellers are sophisticated enough to monitor the US courts through PACER and the like looking for lawsuits that name them or their associates Merchant Storefronts and will drain their related financial accounts upon any notice that a lawsuit is filed against their activity.

7. Based upon my personal experience and my review of lawsuits filed by other brand owners, I have learned that the Defendants selling on online marketplaces do not display their registered business name or trade name, contact name, complete address, phone numbers, or any other contact information. These Defendants use their respective Merchant Storefronts and User Accounts to anonymously sell their Infringing Products.[3] Likewise, these Defendants typically use shipping services like EMS and DHL and ePacket. These shipping services provide

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1 As defined in the Complaint, a "User Account" is any and all accounts with online marketplace platforms such as Amazon.com, eBay.com, aliexpress.com, and wish.com, as well as any and all as yet undiscovered accounts with additional online marketplace platforms held by or associated with Defendants, their respective officers, employees, agents, servants and all other persons in active concert with any of them.

2 As defined in the Complaint, a "Merchant Storefront" is any and all User Accounts through which Defendants, their respective officers, employees, agents, servants and all persons in active concert or participation with any of them operate storefronts to manufacture, import, export, advertise, market, promote, distribute, display, offer for sale, sell and/or otherwise deal in products, including Infringing Products, which are held by or associated with Defendants, their respective officers, employees, agents, servants and all persons in active concert or participation with any of them.

3 Defendants have willfully infringed one or more of the claims of U.S. Patent No. 10,834,894 ("Plaintiff's Patent" or "the '894' Patent") by offering for sale, selling, and distributing knock-off versions of Plaintiff's Slow Treater® Brand dog soothing device ("Infringing Products").

minimal tracking and/or use incomplete or made up return addresses to further secret their identities.

8. Based upon the foregoing facts, supported by the evidence set forth in **Composite Exhibit 1**, it is submitted that providing notice of the Motion for Temporary Restraining Order and the restraints of the Defendant's Merchant Storefronts and Accounts would allow the Defendants to avoid the Court's Order thus depriving the Plaintiff of any damage recovery and otherwise prevent the full operation of the Court's Order.

9. To prevent the Defendants from escaping the effects of the Court's Order, Plaintiffs, Plaintiffs' Counsel and their agents have not publicized the filing of this lawsuit or the request for *ex parte* relief.

10. It is respectfully submitted that based upon the Complaint allegations, and the declarations and exhibits submitted therewith, Plaintiff has met the requirements of Fed. R. Civ. P. 65 (b) in its application to the court for an Ex Parte Temporary Restraining Order because:

(a) the specific facts in the affidavit and the verified complaint clearly show that immediate and irreparable injury, loss, or damage will result to the movant before the adverse party can be heard in opposition; and

(b) the movant's attorney (undersigned) has herein certified in writing that notice would, in this case, defeat the purposes of the application for the *ex parte* temporary restraining order and asset restraint.

I declare under penalty of perjury that the foregoing is true and correct.

Dated: Pittsburgh, Pennsylvania
December 16, 2020

/Stanley D. Ference III/
Stanley D. Ference III

EXHIBIT 1

Intellectual Property Rights

Fiscal Year 2018 Seizure Statistics

Prepared by

U.S. Customs and Border Protection
Office of Trade

Homeland Security

Table of Contents

Executive Summary.....6

Year in Review.....7

IPR & E-Commerce.....15

Fiscal Year 2018 IPR Seizure Statistics.....16

Number of Seizures by Product.....20

Products Seized by MSRP.....22

Total MSRP for Products Seized by Economy.....24

Seizures by Economy.....26

Seizures by Shipping Environment.....28

Health, Safety, and Security.....30

Exclusion Orders.....32

Centers of Excellence and Expertise.....33

IPR Points of Contact.....34

Disclaimer: The information contained in this report does not constitute the official trade statistics of the United States. The statistics, and the projections based upon those statistics, are not intended to be used for economic analysis, and are provided for the purpose of establishing U.S. Department of Homeland Security workload.

Executive Summary

Products that infringe U.S. trademarks and copyrights are subject to exclusion orders issued by the United States International Trade Commission threaten the health and safety of American consumers and pose risks to our national interests. U.S. Customs and Border Protection (CBP) and U.S. Immigration and Customs Enforcement (ICE) Homeland Security Investigations' (HSI) enforcement of intellectual property rights (IPR) mitigates the financial and welfare risks posed by imports of illicit products.

Each year, more than 11 million maritime containers arrive at our seaports. At our land borders, another 10 million arrive by truck and 3 million arrive by rail. An additional quarter billion more cargo, postal, and express consignment packages arrive through air travel. The Department of Homeland Security (DHS) remains vigilant in targeting shipments containing IPR-infringing goods, levying civil fines and criminally investigating those who seek to violate our trade laws, harm consumers, and damage our economy.

In fiscal year (FY) 2018, the number of IPR seizures decreased by 333 seizures to 33,810 from 34,143 in FY 2017. The total estimated manufacturer's suggested retail price (MSRP) of the seized goods, had they been genuine, increased to nearly $1.4 billion from over $1.2 billion in FY 2017.

In FY 2018, ICE-HSI arrested 381 individuals, obtained 296 indictments, and received 260 convictions related to intellectual property crimes.

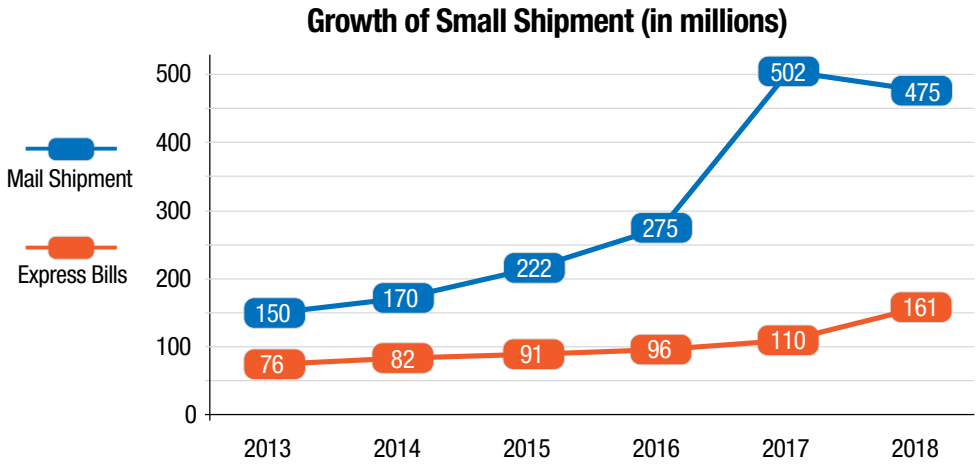
IPR & E-Commerce

E-commerce sales, including those through third-party platforms, have resulted in a sharp increase in the shipment of small packages into the United States. In FY 2018, there were 161 million express shipments, and 475 million packages shipped through the international mail environment.

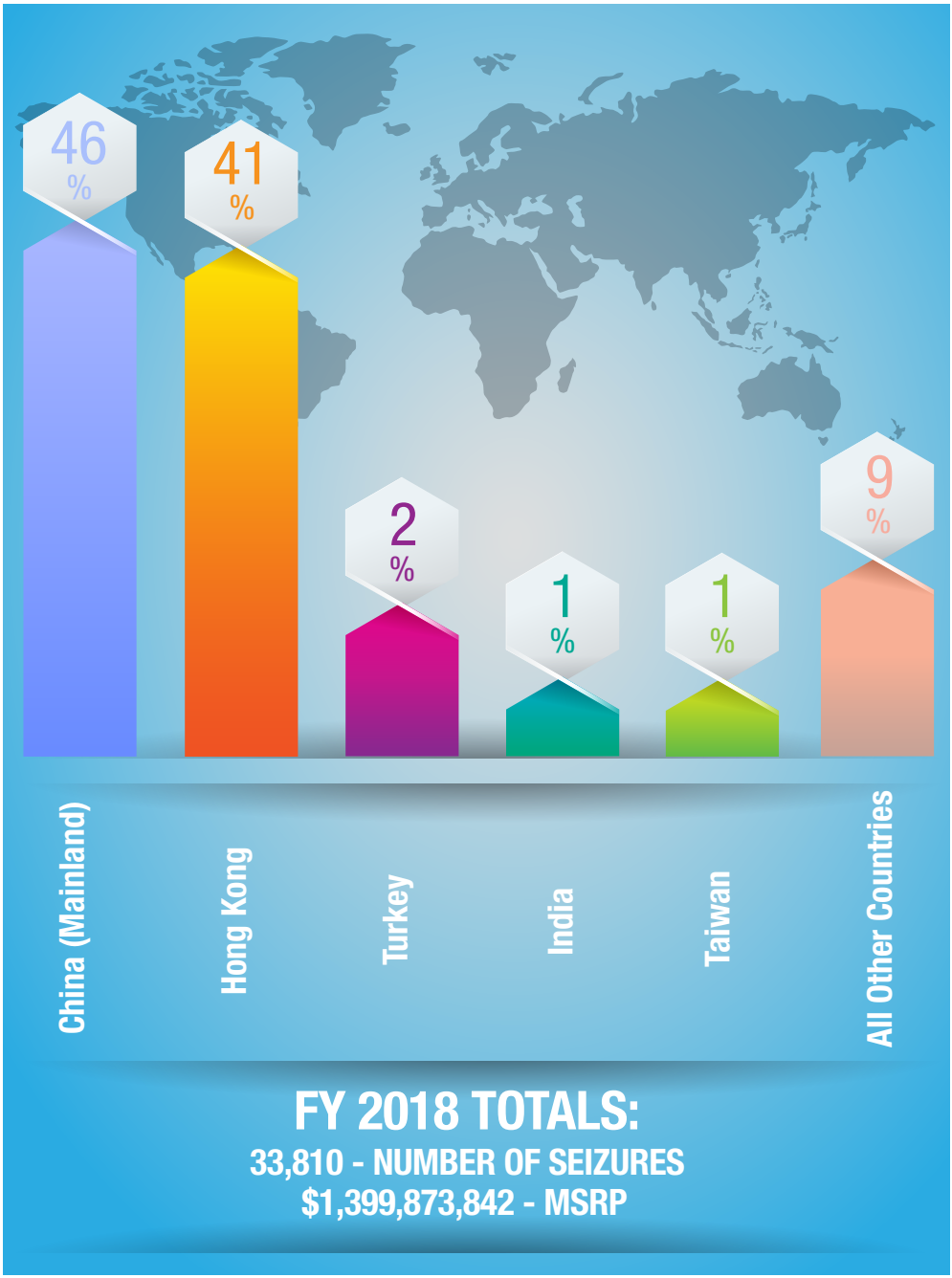
Over 90% of all intellectual property seizures occur in the international mail and express environments. A majority of those fall under the de minimis threshold of $800.

In March 2018, CBP released its CBP E-Commerce Strategy. The strategy strengthens CBP's ability to protect the public and U.S. economy from noncompliant goods. The strategy drives compliance and enforcement, and promotes coordination. CBP is working toward implementation.

More e-commerce related information can be found at https://www.cbp.gov/trade/basic-import-export/e-commerce



FISCAL YEAR 2018 IPR SEIZURE STATISTICS
BY NUMBER OF SEIZURES



FY 2018 TOTALS:

33,810 - NUMBER OF SEIZURES

$1,399,873,842 - MSRP

EXHIBIT 2

Global Innovation Policy Center

June 20, 2016

U.S. Chamber Report Measures the Magnitude of Global Counterfeiting

WASHINGTON, D.C. — The U.S. Chamber of Commerce Global Intellectual Property Center (GIPC) today released *Measuring the Magnitude of Global Counterfeiting* (http://www.theglobalipcenter.com/wp-content/themes/gipc/map-index/assets/pdf/2016/GlobalCounterfeiting_Report.pdf), which provides a breakdown of the share of physical counterfeiting for the 38 economies included in the U.S. Chamber of Commerce International IP Index (http://www.theglobalipcenter.com/gipcindex/).

“From fake medicines to bad brakes and lead-laden toys, counterfeit goods pose a real danger to consumers and a costly threat to the business community,” said Mark Elliot, executive vice president of GIPC. “The 2016 International IP Index shows that leaders in both developing and developed economies increasingly recognize the connection between effective intellectual property protection and achieving their greatest economic potential. Similarly, this counterfeit report provides a closer look at the role individual economies play in this growing, global concern. For example, it is apparent that we need increased focus in the China and Hong Kong markets to combat counterfeits.

“Building on the Chamber’s 38-economy Index, this report provides a tool to inform countries’ efforts to crack down on the global problem, and cut off counterfeits at the source. Our report indicates that the value of goods seized is only a small percentage of the total $461 billion in global trade-related counterfeiting. This signals the need for increased resources for more effective enforcement efforts.”

Similar to data recently released by the Organisation for Economic Co-operation and Development (OECD), GIPC’s report found that as much as 86 percent of all global counterfeits originate in China and Hong Kong’s markets, with the next largest share making up less than half a percent of global counterfeits. The report also suggests that customs authorities are only seizing as little as 2.5 percent of the value of total estimated counterfeits.

The 38 economies, chosen from the U.S. Chamber of Commerce International IP Index, account for nearly 85% of global gross domestic product (GDP). The Index is based on 30 measurable criteria critical to innovation including patent, copyright and trademark protections; enforcement; and engagement in international treaties, among others.

The Index ranks the economies in Algeria, Argentina, Australia, Brazil, Brunei, Canada, Chile, China, Colombia, Ecuador, France, Germany, India, Indonesia, Israel, Italy, Japan, Malaysia, Mexico, New Zealand, Nigeria, Peru, Poland, Russia, Singapore, South Africa, South Korea, Sweden, Switzerland, Taiwan, Thailand, Turkey, Ukraine, United Arab Emirates (UAE), United Kingdom (UK), United States (U.S.), Venezuela, and Vietnam.

The Global Intellectual Property Center is working around the world to champion intellectual property (IP) rights as vital to creating jobs, saving lives, advancing global economic growth, and generating breakthrough solutions to global challenges.

The U.S. Chamber of Commerce is the world's largest business federation representing the interests of more than 3 million businesses of all sizes, sectors, and regions, as well as state and local chambers and industry associations.

EXHIBIT 3

THE ECONOMIC IMPACTS OF COUNTERFEITING AND PIRACY

Report prepared for BASCAP and INTA

Acknowledgements

Frontier Economics Ltd is a member of the Frontier Economics network, which consists of two separate companies based in Europe (Frontier Economics Ltd, with offices in Brussels, Cologne, Dublin, London & Madrid) and Australia (Frontier Economics Pty Ltd, with offices in Melbourne & Sydney). Both companies are independently owned, and legal commitments entered into by one company do not impose any obligations on the other company in the network. All views expressed in this document are the views of Frontier Economics Ltd.

The International Chamber of Commerce (ICC) works to promote a balanced and sustainable system for the protection of intellectual property. It believes that IP protection encourages innovation and the development of knowledge-based industries, stimulates international trade, and creates a favorable climate for foreign direct investment and technology transfer. ICC launched BASCAP (Business Action to Stop Counterfeiting and Piracy) to connect and mobilize businesses across industries, sectors and national borders in the fight against counterfeiting and piracy. Visit BASCAP on the web at: www.iccwbo.org/bascap

The International Trademark Association (INTA) is a global organization of over 7,000 trademark owners and professionals from over 190 countries. INTA is a not-for-profit membership association dedicated to supporting trademarks and related intellectual property in order to protect consumers and to promote fair and effective commerce. The Association was founded in 1878 and today INTA leads the way in global trademark research, policy development, education and training. More details about INTA and its roles are available at www.inta.org

BASCAP and INTA express appreciation to TECXIPIO for their valuable source data contributions to this report. TECXCIPIO is an IT company specialized in building scalable solutions to accurately track and analyse worldwide copyright infringements on the internet. www.tecxipio.com

Frontier Economics Ltd is a member of the Frontier Economics network, which consists of two separate companies based in Europe (Frontier Economics Ltd, with offices in Brussels, Cologne, Dublin, London & Madrid) and Australia (Frontier Economics Pty Ltd, with offices in Melbourne & Sydney). Both companies are independently owned, and legal commitments entered into by one company do not impose any obligations on the other company in the network. All views expressed in this document are the views of Frontier Economics Ltd.

CONTENTS

Foreword

Executive Summary 6
- 1.1 Extending the findings of the OECD/EUIPO 6
- 1.2 Key findings 7
- 1.3 Analytical approach 9
- 1.4 Agenda for future research 9

2 Introduction 11
- 2.1 Background and context 11
- 2.2 Extending the findings of the OECD/EUIPO: estimating the global incidence of counterfeiting and piracy and its effects 12

3 Quadrants 1 and 2: The global value of counterfeiting and piracy 14
- 3.1 Quadrant 1: The OECD/EUIPO's estimates of international trade in counterfeit and pirated goods 14
- 3.2 Quadrant 2: estimating the domestic production and consumption of counterfeit and pirated goods 16
- 3.3 Conclusion and discussion 22

4 Quadrant 3: The global value of digitally pirated goods in specific sectors 23
- 4.1 Introduction 23
- 4.2 Film 23
- 4.3 Music 28
- 4.4 Software 34
- 4.5 Conclusion and discussion 37

5 Quadrant 4: Wider economic costs 40
- 5.1 Introduction 40
- 5.2 Econometric analysis of impacts on economic growth 41
- 5.3 Impacts on displaced economic activity, tax, employment and investment 46
- 5.4 Other social impacts 50
- 5.5 Conclusion 53

6 Conclusions 54
- 6.1 Projections of the future incidence of counterfeiting and piracy 54
- 6.2 Projection of wider social and economic costs 56
- 6.3 Summary of results 56

Annex A Constructing an average price of movies 59

Annex B Constructing an average price of music 60

Foreword

When BASCAP commissioned Frontier Economics to do a report in 2011 on the global impact of counterfeiting and piracy, our aim was firstly to build on the seminal work of the OECD to—for the first time ever—undertake a data-based, econometric approach to quantifying the value of counterfeiting and piracy; secondly, we set out to pick up where the OECD left off, by expanding their work to include several categories of counterfeiting and piracy that they did not address. Our findings were somewhat alarming, in terms of the magnitudes, but also the projections of how the problem of counterfeiting and piracy would continue to grow in the years to follow. At that time, Frontier estimated that the total global economic value of counterfeit and pirated goods was as much as $650 Billion per year, and projected that this figure would grow to almost $1.8 Trillion by 2015.

As 2015 drew to a close, BASCAP, together with the International Trademark Association (INTA), asked Frontier, to update their report. They have found that counterfeiting and piracy continue to grow at an astounding rate. And, despite increased efforts by the private sector, governments, international government organizations and a growing number of NGOs, the problem is getting worse, not better.

This troubling trend was confirmed last year when OECD/EU IPO issued a report updating their original 2008 report on the level of international trade in counterfeit goods, where they found an 80% increase in counterfeiting between 2008 and 2013.

In developing this report, Frontier has once again collaborated with OECD on methodologies and once again addressed additional impacts of counterfeiting a piracy beyond losses associated with cross border trade in fakes. Additionally, the new Frontier study takes a deeper look into the broader social economic impacts of counterfeiting and piracy.

This report shows that the infiltration of counterfeit and pirated products, or *IP theft,* creates an enormous drain on the global economy – crowding out Billions in legitimate economic activity and facilitating an "underground economy" that deprives governments of revenues for vital public services, forces higher burdens on tax payers, dislocates hundreds of thousands of legitimate jobs and exposes consumers to dangerous and ineffective products.

We commissioned the original Frontier report and this update because we believe that reliable information on the scope, scale, costs and impacts of counterfeiting and piracy is critical for helping policymakers to better understand that the trade in fakes is damaging their economies, threatening the health and safety of their citizens and stifling innovation and creativity.

BASCAP and INTA hope that better information on how counterfeiting and piracy undermine IP, innovation, economic growth and employment, will better enable policymakers to make the fight against IP theft a higher public policy priority – and take the actions needed to prevent the damage inflicted by counterfeiting and piracy.

BASCAP and INTA will continue to explore ways to add further research on this critical issue, and to work together and with other stakeholders to build greater awareness of the enormous costs of counterfeiting and piracy.

EXECUTIVE SUMMARY

Counterfeiting and piracy are highly pervasive across countries and sectors, representing a multi-Billion-dollar industry globally that continues to grow. Measuring the scale of counterfeiting and piracy helps us to understand the size of the problem, and the related social costs. It also helps inform policymakers so that they can target resources appropriately towards combating counterfeiting and piracy.

1.1 Extending the findings of the OECD/EUIPO

Our starting point is the recent work undertaken by the Organization for Economic Cooperation and Development (OECD) and European Union Intellectual Property Office (EUIPO) to measure the extent of piracy and counterfeiting in international trade.[1] The OECD/EUIPO Report builds on a previous, ground-breaking study by the OECD in 2008. Since the publication of the initial report, researchers at the OECD have been able to bring significant enhancements to their research methodology, including improved econometric modelling, greater magnitudes of data and increased primary data from customs experts.

The OECD/EUIPO estimates that trade in counterfeit and pirated products accounted for as much as 2.5% of the value of international trade, or $461 Billion, in 2013.[2] Notably, this figure represents an increase of more than 80% over the OECD's findings in 2008.

Our report seeks to quantify the global value of counterfeiting and piracy and related economic and social costs. As revealing as the OECD/EUIPO Report is, its focus is on one specific aspect of counterfeiting and piracy: the international trade of counterfeits across borders.

We therefore draw on and extend the OECD/EUIPO Report to include additional types and impacts of counterfeiting and piracy delineated, but not quantified, in their analysis. Specifically, this study quantifies three additional categories of losses: (i) the value of domestically produced and consumed counterfeit goods, (ii) the value of digital piracy, and (iii) wider economic impacts. Our approach and analysis is a follow-on study from our 2011 report for BASCAP, which built on the OECD's 2008 analysis.

Our analysis consists of the following four dimensions.

- **Quadrant 1: Internationally traded counterfeit and pirated goods.** We reprise the OECD/EUIPO's recent estimates of the value of counterfeit and pirated physical goods in international trade. This captures the value of counterfeit goods that cross international borders. We also develop projections of this value to 2022.
- **Quadrant 2: Domestically produced and consumed counterfeit and pirated goods.** We estimate the value of domestically produced and consumed counterfeit and pirated goods using the findings of the OECD/EUIPO Report as a starting point. This

[1] OECD/EUIPO (2016), Trade in Counterfeit and Pirated Goods: Mapping the Economic Impact, OECD Publishing, Paris. Available at: http://dx.doi.org/10.1787/9789264252653-en. (hereinafter "OECD/EUIPO Report")

[2] Ibid.

captures the value of counterfeits that are produced and consumed within the borders of a country.

- **Quadrant 3: Piracy distributed through the Internet, mainly by peer-to-peer (P2P) sharing and streaming.** We estimate the value of digital piracy in film, music, and software, which is not captured in the OECD/EUIPO Report as it is based on physically traded goods. Our analysis draws on industry data and studies.
- **Quadrant 4: Wider economic and social impacts.** Building on the magnitudes calculated in quadrants 1-3, we measure related economic and social impacts of counterfeiting and piracy. Specifically, we:
  - Develop an econometric estimate of the impact of counterfeiting and piracy on foregone economic growth.
  - Present effects of the displacement by counterfeiting and pirating activities of legitimate activities on employment, FDI, and sales tax revenues.
  - Estimate costs of criminality related to counterfeiting and pirating activities

1.2 Key findings

Our analysis shows that the scale of counterfeiting and piracy globally is large, that it has grown since previous estimates, and that this growth is expected to continue. Our estimates of these values across all four quadrants are shown in Table 1.S below.

We estimate that the value of international and domestic trade in counterfeit and pirated goods in 2013 was $710 -$ 917 Billion. We estimate that, in addition to this, the global value of digital piracy in movies, music and software in 2015[3] was $213 Billion.

We estimated wider economic costs associated with the effects of counterfeiting and piracy on the displacement of legitimate economic activity. This estimate also provides a starting point for inferring fiscal losses. We also estimated the effects of counterfeiting and piracy on Foreign Direct Investment (FDI) and crime. The results are reported in Table 1 below.

[3] Digital piracy is calculated from 2015 data, which is the most recently available data

Table 1.Summary of estimates of counterfeiting and piracy

Quadrant	Estimate	2013	2022 (forecast)
1	Total international trade in counterfeit and pirated goods	$461 Billion	$991 Billion
2	Total domestic production and consumption of counterfeit pirated goods	$249 - $456Billion	$524 - $959 Billion
3	Digital piracy in movies, music and software	$213Billion	$384 - $856 Billion
	- Digital piracy in film	$160 Billion	$289-644 Billion
	- Digital piracy in music	$29 Billion	$53-117 Billion
	- Digital piracy in software	$24 Billion	$42-95 Billion
	Total value of counterfeit and pirated goods	**$923 Billion – 1.13 Trillion**	**$1.90 -$2.81 Trillion**
4	Wider economic and social costs		
	- Displacement of legitimate economic activity	$470-$597 Billion	$980-$1244 Billion
	- Estimated reduction in FDI	$111 Billion	$231 Billion
	- Estimated fiscal losses	$96-$130 Billion	$199-$270 Billion
	- Estimated costs of crime	$60 Billion	$125 Billion
4	**Total Wider economic and social costs**	**$737-$898 Billion**	**$1.54 - $1.87 Trillion**
	Estimated employment losses	**2-2.6 million**	**4.2-5.4 million**
	Foregone economic growth in OECD 2017	**$30 Billion to $54 Billion**	

Source: Frontier estimates based on OECD 2013 data on counterfeiting in international trade, and UN trade and GDP data to derive estimates for domestic production and consumption. Data for Piracy based on latest industry sources (2015).

We find significant effects on the job market through the displacement of legitimate economic activity by counterfeiting and piracy. We estimate net job losses in 2013 to lie, globally, between 2 and 2.6 million, and we project net job losses of 4.2 to 5.4 million by 2022.

We also estimated the effects of changes in the incidence of counterfeiting and piracy on economic growth. Our econometric model, estimating the impact of changes in the intensity of counterfeiting and piracy on economic growth, suggests that a percentage point reduction in the intensity of counterfeiting and piracy would be worth between $30 Billion to $54 Billion in 2017 for the 35 OECD countries.

Table 1 also reports forward projections out to the year 2022.

Our forward projections begin with OECD/EUIPO's estimates of international trade in counterfeit and pirated goods, augmented by forecasts of growth in import volumes and the ratio of customs seizures to real imports. Using these, we forecast that the value of trade in counterfeit and pirated goods could reach **$991 Billion** by 2022.

We carry out a similar exercise to illustrate how the size of domestic production and consumption of counterfeit and pirated goods may change over time. We use data on recent and forecast rates of growth in global trade and GDP, and projected growth in the rate of counterfeiting. Using this approach, we forecast that the value of domestically produced and consumed counterfeit and pirated goods could range from **$524 - $959 Billion** by 2022.

Applying the methodology used in our previous study, we combine two different approaches to project digital piracy into the future. The first approach assumes that digital piracy will maintain its share of total counterfeiting and piracy over time. The second approach assumes that digital piracy grows proportionally to global IP traffic. Combining these two approaches, we forecast that the value of digital piracy in movies, music and software could reach from **$384 - $856 Billion** by 2022.

1.3 Analytical approach

As recognised in the OECD/EUIPO Report, the estimation task is necessarily complicated by the fraudulent nature of counterfeiting, which relies on the activity being hidden from view. The OECD/EUIPO Report addresses this challenge via an innovative analytical approach that uses data on customs seizures. Individual sectors have also relied on surveys to understand the scale of counterfeiting and piracy that they face, as well as collecting data on the prevalence of counterfeiting and piracy as part of their routine IP enforcement activities.

To estimate the scale and impacts of counterfeiting and piracy, we use and build on the OECD/EUIPO Report, bringing in additional publicly available data from reputable sources such as the UN Statistics Division. We have drawn on industry data to develop our estimates of digital piracy. Throughout our analysis, we have engaged closely with relevant sector bodies to ensure that our approach is robust and the data sources are reliable.

To account for the significant uncertainty around the value of counterfeiting and piracy, we use conservative assumptions in our estimates, and provide ranges for our estimates. The main report sets out the data sources and assumptions used in detail, and the impact of the assumptions made on the interpretation of our analysis.

1.4 Agenda for future research

It is important to continue to highlight the scale of the challenge posed by counterfeiting and piracy globally. We believe that a number of next steps are important, including the following.

- Further research into the prevalence of counterfeiting and piracy of physically traded goods that don't cross borders. Our analysis infers the prevalence of

domestically produced and consumed counterfeits using the OECD/EUIPO analysis of internationally traded counterfeits. Further research would help ensure more precise estimates of the scale of domestic counterfeiting in future.

- The digital piracy landscape is changing rapidly. Further data collection and analysis to understand the scale of growing forms of digital piracy (e.g. gaming, copyright infringing user generated content, TV series) would help policymakers to better address policies to the problem of digital piracy.
- Further analysis of and improvements to the customs seizures data that underlies the OECD/EUIPO analysis would be beneficial, for example in helping policymakers build up a picture of how prevalence of counterfeiting in different sectors and geographies varies year on year.

2 INTRODUCTION

2.1 Background and context

Counterfeiting and piracy are a form of theft. They involve the illegitimate acquisition and use of intellectual property (IP). The economic and social costs of counterfeiting and piracy are thus similar to those associated with other types of theft (e.g. personal property theft). Counterfeiting and piracy divert private and public resources which could otherwise be used for more productive ends, into the illegal acquisition of IP, or defending IP from such illegal acquisition.[4]

However, the economic costs of counterfeiting and piracy extend well beyond these traditional costs of theft. First, they reduce the returns to innovation. While there are ongoing debates about the optimal level of IP protection to balance the rights of innovators and the users of IP, counterfeiting and piracy hurts *both* the innovator and the user. The economic costs of IP erosion through counterfeiting and piracy are particularly severe in knowledge-driven economies.

Secondly, whereas classical analyses of property theft treat the theft itself as a transfer – and therefore not in and of itself a cost – in practice, that approach is not valid in the case of counterfeiting and piracy. This is because of the close links between counterfeiting activities and other forms of criminal activities. Thus, counterfeiting and piracy are a "cost" not a transfer because they stimulate other "costs", i.e. activities that adversely impact on social well-being.

Counterfeiting and piracy are therefore specific economic and social "bads". Measuring the size of counterfeiting and piracy is therefore important for several reasons.

- First, it helps us to understand the size of the problem. The extent of these activities is an indicator of the extent to which IP is eroded globally, and a measure of the extent to which productive resources and consumption are diverted to illicit activities.
- Secondly, measuring the magnitude of the problem serves as a platform for measuring related costs. These include the social costs associated with the displacement of employment in legal activities, the economic costs of the erosion of IP, and the social costs associated with criminal activities linked to counterfeiting and piracy.

Thus, measuring the extent of this problem helps us to draw inferences as to the extent of the economic and social costs arising from counterfeiting and piracy. This helps inform policymakers so that they can target resources appropriately towards combating counterfeiting and piracy.

In order to do this, this report begins by building on the recent, ground-breaking work undertaken by the OECD and EUIPO to measure the extent of piracy and counterfeiting

[4] See in particular Gordon Tullock (1967), "The welfare costs of tariffs, monopolies, and theft", Western Economic Journal, Vol 5.3

in international trade.[5] As revealing as the OECD/EUIPO Report is, it only focuses on one specific aspect of counterfeiting and piracy, namely that related to the *international* trade of these products across borders. This report extends the analysis to consider other dimensions, as described below.

2.2 Extending the findings of the OECD/EUIPO: estimating the global incidence of counterfeiting and piracy and its effects

We draw on and extend the OECD/EUIPO Report to estimate the following dimensions of counterfeiting and piracy globally.

- **Quadrant 1: Internationally traded counterfeit and pirated goods.** We report the OECD/EUIPO's estimates of the value of counterfeit and pirated physical goods in international trade. This captures the value of counterfeit goods that cross international borders. We also develop projections of this value to 2022.
- **Quadrant 2: Domestically produced and consumed counterfeit and pirated goods.** It is necessary to compute this value as it provides an indication of the true size of the counterfeit economy by capturing the level of counterfeits that are produced and consumed within the borders of a country. This is especially true of larger economies, in which trade is a lower proportion of GDP than is the case in smaller economies. In section 3.2 we develop a methodology for inferring the value of domestically produced and consumed pirated goods using the findings of the OECD/EUIPO Report as a starting point. This captures the value of counterfeits that are produced and consumed within the borders of a country.
- **Quadrant 3: Piracy distributed through the Internet, mainly by peer-to-peer (P2P) sharing and streaming.** It is necessary to focus on this specifically because the OECD/EUIPO Report analysis is based on physically traded goods, i.e. ones that are transported from point to point. However, for sectors such as film, music, and software, physical transportation is not the only or even primary mode of disseminating products. We therefore need to consider the role illegal online activity plays in substituting for legitimate modes of distribution and consumption – whether physical or online – to estimate the true size of piracy. Section 4 sets out our analysis of digital piracy, which focuses on digital piracy in film, music, and software.
- **Quadrant 4: Wider economic and social impacts.** Building on the magnitudes calculated in quadrants 1-3, we measure related economic and social impacts of counterfeiting and piracy. These include costs related to displacement of employment, erosion of intellectual property (IP), and criminal activities linked to counterfeiting and piracy. This is done in section 5.

In the remainder of the report, we describe our analysis of each quadrant in turn. In the concluding section, we project our estimates forward to 2022 to provide an indication of

[5] OECD/EUIPO (2016), Trade in Counterfeit and Pirated Goods: Mapping the Economic Impact, OECD Publishing, Paris. Available at: http://dx.doi.org/10.1787/9789264252653-en. (hereinafter "OECD/EUIPO Report")

how counterfeiting and piracy is likely to develop over time; results are summarised across all four quadrants.

3 QUADRANTS 1 AND 2: THE GLOBAL VALUE OF COUNTERFEITING AND PIRACY

3.1 Quadrant 1: The OECD/EUIPO's estimates of international trade in counterfeit and pirated goods

The first category of estimates, as referenced in section 2.1, are derived directly from the research undertaken by the OECD and the EUIPO, on the extent of counterfeiting in international trade.[6] The OECD/EUIPO Report estimates that trade in counterfeit and pirated products accounted for as much as 2.5% of the value of international trade, or $461 Billion, in 2013.[7] In the report, China emerged as the primary origin of counterfeits imported into the EU. This is in line with US customs seizures data, which shows that 52% of seized counterfeit imports into the US originated from China.[8]

$461bn

The OECD/EUIPO estimates that international **trade in counterfeit and pirated products** accounted for as much as 2.5% of the value of international trade, or $461 Billion, in 2013.

The range of products found to be affected by counterfeiting and piracy is broad. Affected goods span luxury consumer products such as leather goods, common consumer products such as toys and pharmaceuticals, and business-to-business products including spare parts and chemicals.

Similarly, the OECD/EUIPO Report found that counterfeit and pirated products originate from nearly all economies. However, there is variation in prevalence by geography. It found higher prevalence of counterfeiting in trade in the EU, estimating that counterfeit and pirated goods accounted for up to 5% of imports in the EU, or $116 Billion, in 2013. Middle-income and emerging economies were often found to be transit points or producing economies of internationally traded counterfeit and pirated goods.

Comparison of the 2013 estimates with previous analysis by the OECD indicates increasing counterfeiting and piracy in international trade over time. The OECD estimated that in 2008, internationally traded counterfeit and pirated products represented up to 1.9% of global imports, or $200 Billion.[9] The 18% annual estimated

[6] OECD/EUIPO (2016), Trade in Counterfeit and Pirated Goods: Mapping the Economic Impact, OECD Publishing, Paris.

[7] Ibid.

[8] For the fiscal year 2015, measured by value (the manufacturer's suggested retail price). US Department of Homeland Security, Intellectual Property Rights Seizure Statistics, Fiscal Year 2015.

[9] OECD (2008), The Economic Impact of Counterfeiting and Piracy.

growth is likely driven in part by the ongoing priority assigned to IP crimes and the lack of additional resources committed to IPR enforcement since the 2008 report. Other factors include revival in trade following the 2008 crisis, and growth in e-commerce. We project the OECD/EUIPO estimates forward in Section 6.1 to provide an indication of likely future growth in traded counterfeits. We forecast that the value of trade in counterfeit and pirated goods could reach $991 Billion by 2022.

3.1.1 Comments on methodology

The OECD's analysis of 2008 was ground-breaking: it was the first attempt to systematically estimate the incidence of counterfeiting and piracy in international trade. The estimation task is necessarily complicated by the fraudulent nature of the trade in fakes, which relies on the activity being hidden from view. Since the publication of the initial report, researchers at the OECD have been able to bring significant enhancements to their research methodology, including improved econometric modelling, greater magnitudes of data and increased primary data from customs experts.

The latest estimates published in the OECD/EUIPO Report benefit from improved data relative to the 2008 study, which meant that the assumptions required to estimate trade in counterfeit and pirated products were less restrictive. One of the implications is that the 2008 and 2013 estimates are not fully comparable, as some changes in the estimates could be attributable to these data and methodology improvements.

The OECD/EUIPO Report used three main sources of evidence:

- customs seizures data from:
  - the World Customs Organization (WCO),
  - the European Commission's Directorate-General for Taxation and Customs Union (DG TAXUD), and
  - the United States Department of Homeland Security (DHS);
- world trade data from the United Nations (UN) Comtrade database; and
- qualitative evidence from structured interviews with customs officials.

We outline the key changes in assumptions between the estimates of counterfeiting and piracy in 2008 and 2013 in Table 15 below. It shows that the recent OECD/EUIPO Report benefits from separate estimates of traded counterfeit and pirated products for 2011, 2012 and 2013, as well as improved availability of evidence to use in estimating relative and actual counterfeiting and piracy propensities. The previous strong assumption of minimum counterfeiting rates where data was missing resulted in an overestimate of overall counterfeiting. By relaxing this strong assumption, the OECD/EUIPO's more recent analysis is more accurate, although the change in assumptions also limits the comparability of the new and old estimates over time.

Some important assumptions remain, in particular the use of a 'fixed point' to estimate actual counterfeiting propensities. See box in Section 3.2.1 for a description of the approach to estimating the fixed point.

Table 2. Improvements in the approach between 2008 and 2016

Aspect of analysis	Assumptions and approach in 2008	Assumptions and approach in 2016
Time dimension	Data was pooled to produce an estimate for 2008 only.	Data not pooled, separate estimates are available for 2011, 2012 and 2013.
Estimation of *relative* counterfeiting propensity	Relative propensities were estimated using data on the value of seized goods, numbers of seizures and numbers of seized goods. This required assumptions to convert quantity data to monetary values. Non-zero minimum levels of counterfeiting were assumed where data was missing. This strong assumption resulted in potential overestimates of counterfeiting.	Relative propensities were estimated using data on the value of seized goods. This avoided the need for assumptions to convert quantity data to monetary values. More reasonable assumption on minimal levels of counterfeiting was used, due to improved data quality. This results in more accurate estimates of counterfeiting.
Estimation of *actual* counterfeiting propensity	Relative propensities were converted to actual propensities using a single estimate of the actual rate of counterfeits in exports of one good from one economy (the 'fixed point') to one of its export partners. The fixed point was selected based on informal interviews.	The approach remains the same, but the fixed point was selected based on structured interviews and focus groups with customs and enforcement officials.

Source: Adapted from Table 3.2, OECD/EUIPO Report

Note: The 'fixed point' is the estimated actual counterfeiting propensity for the economy/product pair with the highest expected rate of counterfeiting. See Section 3.2.1 for full explanation.

3.2 Quadrant 2: estimating the domestic production and consumption of counterfeit and pirated goods

We extend the OECD/EUIPO analysis to estimate the value of counterfeit and pirated goods that are both produced and consumed domestically, i.e. goods that are *not* traded across international borders. While the OECD/EUIPO did not include analysis of domestically produced and consumed counterfeiting and piracy, they acknowledge that more investigation was needed into this area. Alternative models and existing data can be used to estimate the value of domestic counterfeiting and piracy. Calculating this value provides an additional indication of the true, global size of the counterfeit and piracy economy.

In this section, we describe:

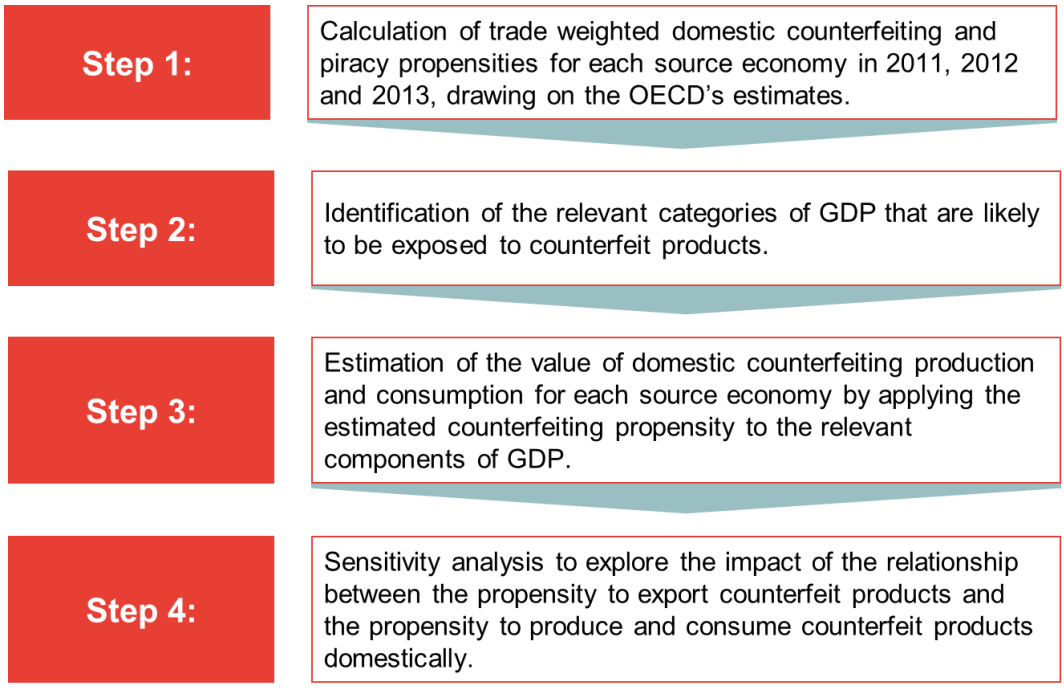
- the approach we have taken to estimating the scale of domestic production and consumption of counterfeit goods;
- the data sources our estimates draw on; and
- the results of our analysis.

3.2.1 Methodology

Limited or non-existent government or other conventional sources of data presents a challenge to estimating magnitudes of counterfeiting and piracy in this quadrant. Consequently, to address the significant uncertainties associated with estimating the scale of domestic counterfeiting and piracy, we bring together the best available data sources, presenting estimates as ranges where appropriate.

We once again start with and build on the OECD/EUIPO's estimates of internationally traded counterfeiting and piracy. This follows the approach used in our previous analysis.[10] The analysis follows four steps, shown in Figure 1 below. As explained in section 3.2.2 below, we supplement OECD data with data from the United Nations on GDP and Comtrade, to arrive at an estimate for domestic counterfeiting.

Figure 1: Approach to estimating domestic counterfeiting and piracy



Source: Frontier Economics

To estimate domestic counterfeiting propensities, we start from the OECD/EUIPO's estimates of the maximum relative propensity of economies to export counterfeit and pirated products. This information is summarised in two indices developed by the OECD:

[10] Frontier Economics for BASCAP, 2011, Estimating the global economic and social impacts of counterfeiting and piracy

- the GTRIC-p index, which shows the relative propensity of world trade to be counterfeit for different products; and
- the GTRIC-e index which shows the relative propensity of internationally traded counterfeit products to originate from different source economies.

The indices can be combined to estimate relative counterfeiting propensities for each source economy and product combination. For example, the GTRIC-p index shows that, in 2013, counterfeit footwear was 1.9 times more likely to originate from China than India.

To estimate absolute counterfeiting propensities, the OECD/EUIPO use a "fixed point." We describe the fixed point and the approach to estimating it in the box below.

ESTIMATING THE "FIXED POINT"

The GTRIC estimates show *relative* counterfeiting propensities. To convert these into estimates of *absolute* counterfeiting propensities, the OECD/EUIPO use a "fixed point." This is the actual counterfeiting rate for the source economy and product combination with the highest rate of counterfeiting.

The highest rate of counterfeiting was estimated to be for exports of footwear from China. It was found that, for some EU members, the rate of counterfeits in total imports of footwear from China reached 27%.

The OECD/EUIPO assume that this counterfeiting rate applies to all other shoes exported from China, i.e. to non-EU members importing shoes from China. The "fixed point" therefore represents an upper bound estimate of absolute counterfeiting.

All other *actual* counterfeiting rates are estimated using their relative counterfeiting propensity compared to the relative and actual counterfeiting rate for exports of shoes from China. For example, the actual rate of counterfeiting for clothes from China is estimated as:

> *(Relative counterfeiting propensity for clothes from China / Relative counterfeiting propensity for shoes from China) * Actual counterfeiting propensity for shoes from China*

This methodology is repeated to provide estimates of actual counterfeiting rates for all economies and products. Given that the fixed point represents the maximum counterfeiting rate, our analysis of the value of domestic counterfeiting production and consumption using this approach should be interpreted as providing an upper estimate.

3.2.2 Data sources

We use a number of data sources to estimate the value of domestic counterfeiting and piracy, which we describe below.

OECD/EUIPO estimates of counterfeiting and piracy propensities

The OECD/EUIPO Report provides the GTRIC-e and GTRIC-p indices of relative counterfeiting propensities in world trade which underpin its estimates.[11] We combine these indices to form the GTRIC matrix which sets out the relative counterfeiting propensity for each economy and product pair. We then use the estimated "fixed point" to convert the relative counterfeiting propensities into absolute counterfeiting propensities for each source economy and product pair.

UN GDP data

We use UN GDP data from the UN Statistics Division Statistical Database.[12] For each economy, this reports gross value added, broken down by the International Standard Industrial Classification of All Economic Activities (ISIC).

The product classification used in the OECD/EUIPO Report is based on identifying products sensitive to counterfeit trade at the HS classification level.[13] HS product classifications are relevant to world trade, but they do not map directly to ISIC GDP classifications. In line with our previous analysis, we therefore focus on one category of GDP – manufacturing (ISIC D).

This approach captures the most relevant and sensitive product categories identified by the OECD/EUIPO Report, although it also includes some products that are not found to be sensitive. This means that our estimates of the value of domestic counterfeiting and piracy should be interpreted as upper estimates.

Comtrade data

Applying estimated counterfeiting propensities to GDP data requires that the propensity estimates are available at the economy level, rather than the product level. We estimate economy level counterfeiting propensities by first estimating the value of counterfeiting and piracy for each combination of product, economy and year. We then aggregate the estimated value of counterfeit trade for each economy and year, and divide this by the value of all trade for the corresponding economy and year. To do this, we draw on UN Comtrade data on the value of global imports by source economy, year and HS code.[14]

Where economies are excluded from the OECD/EUIPO Report analysis or Comtrade data is not available for them, they are not included in our domestic estimates. To estimate the value of domestic counterfeiting and piracy globally, we therefore scale up our estimates to account for the ISIC D GDP represented by these economies. We find that 1-2% of ISIC D GDP is excluded in each year before making this adjustment. In doing this, we are assuming that countries are excluded due to data limitations and that their counterfeiting rates are in line with international averages.

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[11] OECD/EUIPO (2016), Trade in Counterfeit and Pirated Goods: Mapping the Economic Impact, OECD Publishing, Paris.

[12] UN Statistics Division Statistical Databases - National Accounts Main Aggregates - Value added by Economic Activity

[13] The Harmonized Commodity Description and Coding Systems (HS) is an international nomenclature for the classification of traded goods on a common basis for customs purposes.

[14] United Nations Statistics Division, Comtrade data in US dollars.

Industry studies and engagement

Our analysis assumes that there is a direct mapping from the propensity of an economy to export counterfeit and pirated products to its propensity to produce and consume counterfeit products domestically. For some goods or economies, this assumption may not hold – for example in larger economies for which international trade is a smaller share of GDP.

We have therefore drawn on industry studies and engagement to explore the impacts of varying this assumption.

3.2.3 Results

Using the approach described above, we estimate that the total scale of domestic production and consumption of counterfeit and pirated products in 2013 was **$249 - $456 Billion**. This range reflects uncertainty over the relationship between traded and domestically produced counterfeit and pirated products.

$249-456bn

We estimate that the total scale of **domestic production and consumption** of counterfeit and pirated products in 2013 was $249 - $456Billion.

Our previous analysis estimated that the value of domestic counterfeiting and piracy in 2008 was between $140 and $215 Billion.[15] This suggests growth in domestic counterfeiting over time, although our previous estimates are not fully comparable with the updated estimate due to changes in the data and methodology used by the OECD/EUIPO.

Comparing estimates between 2011 and 2013 also indicates growth in domestic counterfeiting over time, with our analysis suggesting that the value of domestic counterfeiting and piracy in 2011 was $193 - $354 Billion. Again, this comparison should be treated with caution, as changes between 2011 and 2013 could be partly driven by changes in the quality of customs enforcement and data collection year on year.

Our upper bound estimate of domestic counterfeiting and piracy, of **$456 Billion**, is underpinned by the assumption that counterfeiting propensities are the same for goods that aren't traded across international borders as for those that are internationally traded.

In practice, this may not always hold, as the structure of traded and domestic counterfeiting production may not be the same in every economy. We engaged with industry stakeholders across a range of sectors to explore how far this assumption may be valid. We found that the structure of counterfeiting production can vary substantially by product type. For example, food and beverage products are typically developed to suit local tastes, resulting in domestically focused production. In turn, this can result in

[15] Not adjusted for inflation.

production of counterfeits being predominantly for domestic rather than international markets. In contrast, for generic consumer electronics, counterfeit production may focus both on domestic and international markets, with the latter potentially combined with assembly taking place in a local market. This can make it difficult to identify whether counterfeit production takes place in a domestic or external market.

Data allowing comparison of counterfeit prevalence between goods produced and consumed domestically versus internationally traded goods is limited. However, some stakeholders noted that they had observed particularly high rates of domestic counterfeiting for specific product categories, higher than the OECD/EUIPO prevalence rates developed for internationally traded goods. While there wasn't sufficient data available for us to test this in our analysis, it implies that our approach of assuming that domestic and international counterfeiting rates are equal may be conservative. More data would be required for specific product categories to confirm this.

To provide a contrasting sensitivity test of our results, in line with our previous analysis, we draw on a study by the Japan Patent Office (JPO). We apply two key findings to our analysis, as follows.[16]

- The JPO study found that counterfeiting and piracy is more prevalent in traded products than domestically consumed and produced products. It found that firms encountered domestically produced counterfeit products at 54.6% of the rate at which they encountered imported counterfeit products. Applying this proportion to all economies in our analysis generates our lower estimate of the global value of domestic counterfeiting and piracy in 2013, of **$249 Billion**.
- The study found that this relationship between traded and domestic counterfeiting varied by geography, so that in practice some economies see higher prevalence of domestic than traded counterfeits and others see the opposite. It found that in Asia domestically produced counterfeit products are more likely to be exported than consumed domestically, while the opposite is true outside Asia. As an alternative sensitivity test to the one described above, we apply these parameters (shown in Table 3 below) to our analysis. This scales down our estimates of domestic counterfeiting in Asia, and scales up our estimates of domestic counterfeiting in the rest of the world up, resulting in an estimate of the value of domestic counterfeiting and piracy in 2013 of **$310 Billion**. Even with this assumption, China still accounts for the largest share of the global total, at $143 Billion, or 46%.

Table 3. Breakdown of domestic counterfeit production into domestic consumption and exports

Region	% of counterfeit goods produced that are:	
	Consumed domestically	Exported
Asia	34%	66%
Rest of world	55%	45%

Source: Frontier analysis of JPO (2005)

[16] Japan Patent Office, March 2005, FY2004 Survey Report on Losses Caused By Counterfeiting

3.3 Conclusion and discussion

Our analysis suggests that the scale of domestically produced and consumed counterfeit and pirated products is significant, substantially adding to the OECD/EUIPO's estimate of the global value of traded counterfeits. Our findings also indicate that both international trade and domestic production and consumption of counterfeit products is likely to have grown substantially since 2008, although the validity of direct comparison of our new results with our previous estimates is limited by changes in the assumptions behind the OECD/EUIPO's analysis.

Table 4 summarises the Quadrant 1 and 2 estimates of counterfeiting and piracy, and also our projections of these values in 2022. We describe our approach to developing the projections in more detail in Section 6.1.

Table 4 Summary of estimates of total traded and domestic counterfeiting

Result	2013	2022 (forecast)
Estimate of total international trade in counterfeit and pirated goods	$461 Billion	$991 Billion
Estimate of total domestic production and consumption of counterfeit and pirated goods	$249 - $456Billion	$524 - $959 Billion

Source: Frontier estimates based on OECD 2013 data on counterfeiting in international trade, and UN trade and GDP data to derive estimates for domestic production and consumption.

4 QUADRANT 3: THE GLOBAL VALUE OF DIGITALLY PIRATED GOODS IN SPECIFIC SECTORS

4.1 Introduction

The OECD/EUIPO Report did not cover digital piracy, and called for separate analysis into its magnitude. In this section we estimate the economic "size" of digital piracy in the following sectors: film, music, and software. By "size" we mean the dollar value of pirated sales in these sectors, which is not the equivalent of economic losses to the legitimate industries.

Since pirated sales do not occur through traditional markets, the value of these sales needs to be inferred. An estimate of the volume of transactions and of their price is therefore required. Estimates of these will need to draw on data sources that are specific to each type of activity. These estimates tell us how big the piracy problem is in terms of the overall market for pirated goods. They do not, however, in and of themselves tell us how big the damage is to holders of IP. What they do provide is an estimate, even if partial, of the magnitude of these "underground" activities, and an indication of the potential value that could be appropriated by rights holders if piracy were to be eliminated. As explained in section 5.1, these estimates also provide a starting point for estimating the costs of piracy to society as a whole.

The three sectors which we focus on — film, music, and software — are sectors where digital piracy has a particularly significant impact, and these sectors account for the bulk of digital piracy. They are also ones for which it is possible to develop reasonable piracy estimates derived from data reported by various market sector participants and data aggregators. We signpost other (currently emerging) areas of piracy throughout the chapter, but a detailed analysis would exceed the scope of this study. We have used the most recent and robust data available from industry sources, which is from the year 2015.

4.2 Film

In the following, we first provide an overview of recent research findings on the impact of piracy in film. We then estimate the commercial value of piracy in film using a "bottom up" approach.

$160bn

We estimate that the commercial value of **digital piracy in film** in 2015 was $160 Billion.

4.2.1 Background to piracy in film

"The general industry evidence appears consistent with a hypothesis that piracy has hurt the movie industry." This statement, taken from Liebowitz (2013)[17], is based on the fact that the introduction of BitTorrent in 2003-04 has coincided with a turning point in the development of film industry revenues. Revenues for sales and rentals of pre-recorded movies in the U.S. declined by more than 20%[18] between 2005 and 2010 after having increased steadily until then. Box office revenues have remained relatively constant during the same period although a gradual 47% rise over the decade leading up to 2002 might have suggested an upward trend would have continued. It seems straightforward to attribute BitTorrent as responsible for these negative developments. However, it is likely that other developments in the market including the emergence of streaming platforms such as Netflix have also played a role in the decline of other modes of movie consumption.[19]

BitTorrent

BitTorrent is a peer-to-peer (P2P) file sharing network. It facilitates the efficient distribution of large files (e.g. entire movies or software) by breaking the files down into smaller segments and enabling users to download these "pieces" from each other rather than from a central server. Because of these characteristics, it has emerged as one of the most popular modes of digital piracy.

As a result, as Liebowitz and several other researchers have noticed, establishing the nature and size of the link between piracy and the movie industry is not as straightforward as the above trends might suggest. Academics disagree on the size of the substitution rate between pirated and purchased movies (i.e. how many fewer authorised versions a pirate would buy as a consequence of watching an unauthorised version).

Nonetheless, most researchers find movie piracy displaces legal movie sales and hence harms the movie industry. This is shown by a number of recent metastudies which are summarised in the box below.

[17] Liebowitz (2013) "The impact of internet piracy on sales and revenues of copyright owners", an abridged version of "Internet piracy: the estimated impact on sales" in *Handbook on the Digital Creative Economy* Edited by Ruth Towse and Christian Handke, Edward Elgar, 2013, p. 35

[18] Compare Liebowitz (2013), figure 2, p. 35

[19] According to Bai J. and J. Waldfogel (2009) "Movie Piracy and Sales Displacement in Two Samples of Chinese Consumers", Working Paper, The Wharton School, University of Pennsylvania, Philadelphia, PA, 'each instance of [piracy] displaces 0.14 paid consumption instances'. According to Rob R. and J. Waldfogel. (2007) "Piracy on the Silver Screen", *Journal of Industrial Economics,* Vol. 55, Issue 3, pp. 379-393, however, 'unpaid first [piracy] consumption reduces paid consumption by about 1 unit'.

METASTUDIES CONFIRM THAT PIRACY HARMS THE MOVIE INDUSTRY

- Smith and Telang (2012)[20] and Danaher, Smith and Telang (2013)[21] conclude that almost all papers that they assess find media piracy to harm sales.
- In 2015[22] the same authors find that out of 21 papers that have examined the link between piracy and sales and were accepted into peer-reviewed journals up to 2014, eighteen find a negative impact and only three find none.
- Liebowitz (2013) arrives at a similar result: Out of the seven articles identified on the impact of piracy on box office revenues or video sales/rentals, all find piracy to be harmful. His analysis leads him to conclude that the harm from piracy to the movie industry is large.

Perhaps the best empirical proof of a negative relationship between piracy and legal sales was the shutdown of Megaupload, a major cyberlocker and filesharing site, in 2012.[23] Danaher and Smith's (2013)[24] analysis attributes increases of between 6.5 to 8.5% in revenues of three large film studios in the first 18 weeks following the closure of Megaupload. This shows that some consumers turn to legal methods of movie acquisition when a major filesharing site has shut down and by extension that online movie piracy displaces digital movie sales.

The following example gives an idea of the scale of harm that can be caused by movie piracy.

ECONOMIC CONSEQUENCES OF MOVIE PIRACY IN AUSTRALIA

In 2011 a study[25] estimated the impact of movie piracy on the Australian economy, based on a survey with 3,500 adults. It found that:

1. some people pirate movies but watch authorised versions afterwards; and
2. only 45% of pirates claim they would have paid to watch authorised versions had they not been able to access a pirate version.

The study concluded that the Australian movie industry had suffered at least A$575m direct consumer spending losses in the 12 months up to Q3 2010. Adding indirect or induced impacts on other industries, movie piracy was found to have caused losses to the total Australian economy of at least A$1.3 Billion in Gross Output (Sales) and 6,100 Full Time Equivalent jobs.

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[20] Smith M. D. and R. Telang (2012) "Assessing The Academic Literature Regarding the Impact of Media Piracy on Sales"

[21] Danaher B., M. D. Smith and R. Telang (2013) "Piracy and Copyright Enforcement Mechanisms", *Innovation Policy and the Economy*, Vol. 14, pp. 25-61

[22] Danaher B., M. D. Smith and R. Telang (2015) "Copyright Enforcement in the Digital Age: Empirical Economic Evidence and Conclusions", Advisory Committee on Enforcement, Tenth Session, Geneva, November 23 to 25, 2015, World Intellectual Property Organization

[23] This event constitutes a "natural experiment" and is hence an ideal study of the impact of piracy on sales.

[24] Danaher B. and M.D. Smith (2013) "Gone in 60 Seconds: The Impact of the Megaupload Shutdown on Movie Sales"

[25] Ipsos MediaCT and Oxford Economics (2011) "Economic consequences of movie piracy in Australia", report on behalf of AFACT. The study covers not only digital piracy but also the acquisition of counterfeit/copied DVDs

In summary, there seems to be consensus on the fact that online piracy damages the movie industry.

Two related questions arising from this insight are *How big is the damage?*, i.e. how big are the business losses and wider economic effects caused by movie piracy?, and *How big is movie piracy?,* i.e. what is the value of pirated movies?. All studies cited above focus on the first question (the damage caused by piracy), while our analysis focuses on the second question.

A recent study by NetNames[26], which has been appraised positively by industry experts, has set the same focus. The study finds that in 2012, infringing bandwidth use in North America, Europe, and Asia-Pacific made up 23.8% of the total bandwidth consumed. The enormous scope of piracy is illustrated by the fact that in January 2013 alone, 432 million unique Internet users sought infringing material.

Our analysis in the following section goes beyond the NetNames findings. We determine the size of piracy not in terms of bandwidth or users but in terms of the monetary value of pirated items.

4.2.2 Estimating piracy in film

Estimating the size of piracy in film is challenging for a number of reasons. One of these is the speed at which both the licit and the illicit sides of the market have been changing since the advent of the Internet. The development of sharing and storing technologies, for example, has substantially influenced the way in which people steal IP. And the emergence of streaming platforms such as Netflix has transformed people's behaviour related to accessing and watching movies. Substitution rates and behavioural patterns in one year may no longer correctly reflect consumers' behaviour a few years later. Therefore, using the most recent data available is crucial.

To estimate the value of movie piracy, we use a "bottom-up" approach that starts from a measure of the volume of film piracy. One such measure is the number of illegal movie downloads via P2P networks, which is collected through specialist data aggregators. This volume measure is then matched with data on film prices – specifically prices associated with the activities for which pirated films are substitutes. The approach is outlined in more detail below.

An alternative methodology for calculating estimates of film piracy is a "top-down" approach which is based on the value of losses incurred through displaced sales. We can infer the commercial value of pirated films from estimated losses using assumptions on the propensity of consumers to substitute illegitimate versions of a film for legitimate versions.[27] This was the approach followed in our previous study for BASCAP. However, as estimates of conversion rates or business losses related to movie piracy have rarely been updated in recent years, such an approach would now be less reliable. We therefore favour the "bottom up" approach.

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[26] Price, D. (2013) "Sizing the piracy universe", NetNames

[27] This propensity indicates how many illegal downloads displace a legal sale and will be referred to as "conversion rate" or "substitution rate" in the following.

The "bottom up" approach starts by using a number of illegal movie downloads per year. TECXIPIO, a company that tracks BitTorrent transactions worldwide, has recorded 18.5 Billion illegal movie downloads via BitTorrent in 2015.

P2P is the most popular method of illicit movie acquisition and BitTorrent is by far the largest P2P network. However, there are other ways of illegally downloading movies including streaming and using Cyberlockers. The NetNames[28] study mentioned above suggests that 39% of total pirating activity is done on BitTorrent. We use this estimate to scale up TECXIPIO's BitTorrent figure, arriving at **47.8 Billion illegal movie downloads in 2015** across all forms of digital movie piracy.

The final step consists of multiplying this number by an average price of legal movie consumption. A recent discussion by Liebowitz[29] suggests that this could be difficult because it is not clear what a pirated movie is a substitute for. On the one hand, watching a pirated movie provides a similar experience to watching a DVD or downloaded/streamed movie at home, which would suggest that a pirated movie is a substitute for any form of (legal) home video. On the other hand, watching a pirated movie could be considered a close substitute for going to the cinema because both provide the possibility to watch the movie as soon as possible after its theatrical release (which home video does not provide because typically movies are available for legal purchase months after their release).

In view of this ambiguity we choose to construct a weighted average price of movies across all different kinds of legal movie consumption, using information on consumers' typical movie watching behaviour from a 2015 Nielsen report on US consumer trends.[30]

Firstly, we infer how consumers split their total movie consumption across different activities. (To give an example, they spend 26% of their "movie-watching" time streaming movies and 14% watching movies in theatres.)[31] We then construct an average price, weighting the reported prices per movie for each of these activities by the shares of consumer time accorded to them. This yields an overall average price of $3.35 per movie. Multiplying this with our above estimate of the total number of illegal downloads, we obtain a **value of pirated movies of about $160 Billion**.

While it would be preferable to use global behavioural patterns and global average prices instead of US data, the required global data is extremely difficult to gather and not publicly available. However, using US data appears to be the best alternative, based on the following considerations:

1. Total filmed entertainment revenue in the US makes up 33% of the global market.[32] This is more than any other single country and means that even if one could construct a global average, this would be significantly influenced by US

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[28] Price, D. (2013) "Sizing the piracy universe", NetNames

[29] Chapter 23: "Internet piracy: the estimated impact on sales" in Towse R. and C. Handke (2013) *Handbook on the Digital Creative Economy,* Edward Elgar, Cheltenham

[30] Nielsen (2015) Home Entertainment Consumer Trends, accessible through http://www.slideshare.net/JonathanBlumKurtz/home-entertaiment-consumer-trends.

[31] The full list can be found in Table 14, Annex A.

[32] PwC (2015) „Filmed entertainment – Key insights at a glance – Nr. 1", excerpt from *Global entertainment and media outlook 2015-2019*

data. In short, the US is probably the single most representative country of global figures.

2. The US is neither the cheapest nor the most expensive country in terms of media costs, so that calculations based on US figures are more likely to be close to the true global average than calculations based on, for example, European figures. For comparison, the usage of European data would suggest an average price of $5.81 (vs. the $3.35 US based price), and a total value of digital movie piracy of $278 Billion in 2015.

4.3 Music

In the following, we first report on recent developments in the music market and research findings on the link between piracy and sales. We then estimate the value of piracy in music using again a "bottom up" approach.

$29bn

We estimate that the commercial value of **digital piracy in music** in 2015 was $29 Billion.

4.3.1 Background to piracy in music

Recent developments in the music market

Looking only at the size of revenues, one could get the idea that the global recorded music industry has not changed significantly between our last report in 2011 ($14.8 Billion) and 2015 ($15.0 Billion).[33] However, some significant changes have taken place. One is that digital revenues have overtaken physical for the first time in history. Another is the rapid expansion of streaming platforms such as Spotify, Rdio and Pandora. The Nielsen Year End Music Reports 2014 and 2015[34], for example, show that on-demand music streams have tripled between 2013 and 2015 – to 317.2 Billion. In comparison, digital permanent downloads comprised 1.0 Billion singles and 0.1 Billion albums, and total physical retail units added up to only 0.1 Billion in 2015. The proportion of total US music revenues from streaming rose from 9% in 2011 to 34% in 2015.[35]

On the one hand, streaming cannibalises music sales because the permanent availability of a vast music collection makes the purchase of individual songs or albums almost unnecessary. The 23%[36] drop in digital permanent downloads and physical units shipped in the US between 2013 and 2015, provides empirical evidence of this hypothesis. On the other hand, streaming seems to erode music piracy because it satisfies consumers'

[33] The numbers stem from IFPI Global Music Report 2016. It should be remembered, however, that there was a significant decline in music revenues in the period 1999-2011 that was most likely caused by piracy via BitTorrent and its predecessors.

[34] 2014 Nielsen Music U.S. Report and 2015 Nielsen Music U.S. Report

[35] RIAA 2015 Year-End Industry Shipment and Revenue Statistics

[36] Based on RIAA 2014 Year-End Industry Shipment and Revenue Statistics (which also presents 2013 figures) and RIAA 2015 Year-End Industry Shipment and Revenue Statistics

demand for cheap, or even free, convenient access for music.[37] The drop of illegal music downloads via P2P-filesharing from 3.2 Billion in 2013 to 2.5 Billion in 2015[38] seems to support this argument. Further evidence is provided by a recent American Assembly study reporting that 48% of the people involved in both streaming and pirating in the U.S. say that they pirate less music because of the growth of streaming services. In Germany, the number is as high as 52%.[39]

Some hope that streaming will be able to commercialize the volume of music that is currently being pirated. This results in what the International Federation of the Phonographic Industry (IFPI) calls the "value gap" and what music sector groups say needs to be fixed if the music industry is to experience sustained growth in the future.[40]

What is particularly relevant about streaming in the context of this report is that it rapidly changes the way in which people access or listen to music – with resulting difficulties for researchers to keep track of legal music consumption patterns and pirating behaviour.

Link between piracy and sales

As shown above, growth in music piracy seems to be slowing down (although the overall scale of piracy remains large). Moreover, the direction and size of the link between music piracy and legal sales are even more hotly debated than for movies. As already described in the section on movie piracy above, recent metastudies[41] show that the vast majority of the literature finds Internet piracy to harm media sales. Liebowitz (2013)[42] also confirms this finding for papers focusing specifically on music. The conclusion of his analysis[43] is notable: 'On average, the findings for music are that the entire decline in sales since 1999 is due to piracy, and these values[44] tend to be in the vicinity of 50%-70% when dollars are measured in inflation adjusted units' (p. 37).

In contrast, the Joint Research Centre of the European Commission (2013)[45] finds the impact of piracy on sales to be small and positive. Using clickstream data, they find that a 10% increase in clicks on illegal downloading websites causes a 0.2% increase in clicks on legal purchasing websites. This suggests that consumers do not consider pirated

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37 This will be further discussed below.

38 TECXIPIO data

39 The American Assembly (2013) "Copy Culture in the US & Germany"

40 IFPI Global Music Report – State of the Industry Overview 2016

41 Smith M. D. and R. Telang (2012) "Assessing The Academic Literature Regarding the Impact of Media Piracy on Sales"; Danaher B., M. D. Smith and R. Telang (2013) "Piracy and Copyright Enforcement Mechanisms," *Innovation Policy and the Economy*, Vol. 14, pp. 25-61; and Danaher B., M. D. Smith and R. Telang (2015) "Copyright Enforcement in the Digital Age: Empirical Economic Evidence and Conclusions", Advisory Committee on Enforcement, Tenth Session, Geneva, November 23 to 25, 2015, World Intellectual Property Organization

42 Liebowitz (2013) "The impact of internet piracy on sales and revenues of copyright owners", an abridged version of "Internet piracy: the estimated impact on sales" in *Handbook on the Digital Creative Economy* Edited by Ruth Towse and Christian Handke, Edward Elgar, 2013

43 An important part of his analysis was converting the results of all papers into a common metric: "the share of the total industry decline that was estimated to be due to filesharing", p. 36

44 "value" here again refers to the share of total industry decline attributed to filesharing

45 Aguiar L. and B. Martens (2013), "Digital Music Consumption on the Internet: Evidence from Clickstream Data", JRC Technical Reports, Institute for Prospective Technological Studies Digital Economy Working Paper 2013/04, Joint Research Centre, European Commission

music as a substitute for legal purchases. Similarly, it has been found that pirates are heavy legal music consumers.[46]

A slightly older study by Oxera (2011)[47] provides a possible yet partial explanation for the findings in the previous paragraph by listing "Hear before you buy" as one of the four main economic reasons for music piracy. In this case, it is possible that piracy increases legal sales because some people may want to be certain that they like a specific song or album before they purchase it. However, the complete list of reasons for pirating, namely

- Unwillingness to pay,
- Hear before you buy,
- Not wanting a whole album, and
- Unavailable to buy,

looks like a negative substitution effect would prevail. This is because the motives "Unwillingness to pay" and "Not wanting a whole album" suggest that consumers are unlikely to purchase a legal version of a song once they have acquired an illegal one. (Note that the reason "Unavailable to buy" is irrelevant for the question of interest). In other words, the majority of the (relevant) reasons suggest that piracy displaces legal sales, which is consistent with the majority of the literature.

Overall, the evidence for the negative effect of piracy on the music industry is convincing and significant.

[46] The American Assembly (2013) "Copy Culture in the US and Germany", Columbia University and MusicWatch (2016) "Bad Company, You Can't Deny", post based on the MusicWatch (2015), "Badquisition" study

[47] Oxera (2011)" Competing with 'free'? The damages of music piracy" Oxera Agenda October 2011

THE COST OF MUSIC PIRACY IN EUROPE

In May 2016 EUIPO published a report on the cost of music piracy in Europe.[48] Applying different forecasting models to IFPI recorded music sales data for 19 European countries for the period 2005-2014, they considered the differences between predicted and actual sales as "losses" and tried to explain these losses with various explanatory variables including GDP growth, GDP per capita and willingness to pirate music. With this method, they found that in 2014, music piracy:

1. caused a loss of 5.2% of revenue (€170 million) to the recorded music industry in Europe,
2. allowed for effects on other industries, including sales losses to the EU economy were €336 million,
3. caused losses of 2,155 jobs and €63 million in government revenue.

However, IFPI criticized the methodology[49] used by EUIPO on the grounds that

1. the model does not take into account long-term and sustained losses through piracy: Industry revenues were already strongly affected by piracy in 2005 so that losses calculated with the above method cannot estimate the total effect of piracy on revenues
2. calculated losses in each country are constrained by that country's legal revenues in previous years: A country with high legal music revenues therefore can show greater losses than one in which the legal music industry may already have suffered severe damage from piracy.
3. it is not clear whether the variables used by EUIPO (e.g. 'the percentage considering it acceptable to download content from the internet when it is for personal use […]; and the growth rate of the World Bank Index of Control of Corruption'[50]) capture the actual levels of piracy in each country.

In sum, IFPI considers EUIPO's results to be underestimates of the losses actually suffered by the music industry.

4.3.2 Estimating piracy in music

In order to quantify the commercial value of digitally pirated music, we proceed in a similar way as we did for movies. For data reasons, we again favour a bottom-up approach over a top-down approach[51], which means that we multiply the number of illegal music downloads by an average price of recorded music.

The starting point for our calculation is the number of illegal music downloads via BitTorrent networks provided by TECXIPIO. In 2015 they amounted to 2.5 Billion.

[48] EUIPO (2016) "The Economic Cost of IPR Infringement in the Recorded Music Industry"

[49] We received this information in our conversations with IFPI.

[50] EUIPO (2016) "The Economic Cost of IPR Infringement in the Recorded Music Industry", p. 13

[51] Most crucially, we were unable to find a recent and robust estimate of global economic losses due to music piracy. Instead, we have reliable data on the global volume of illegal music downloads (from TECXIPIO) and the prices of different music mediums in the US (from RIAA) so that a bottom-up approach would appear as sufficiently robust.

According to MusicMetric[52], 22% of all BitTorrent music downloads are singles and 78% are albums. Assuming an average of 10 tracks per album, we can calculate 19.7 Billion downloaded **tracks** via BitTorrent networks in 2015.

Although the use of P2P networks has long been the most popular method of unlicensed music acquisition, it is by far not the only one. Over the last decade, the emergence of various new forms of music piracy such as streamripping, the use of mobile apps or downloading from storage lockers has caused a decrease in the prevalence of P2P services. MusicWatch estimates that the number of Americans that use P2P services has decreased from 41 million to 22 million in the period 2004-2015 while the total number of Americans that engage in music piracy of some form has risen to 57 million.[53] Nonetheless, since BitTorrent is particularly well suited (and as shown above primarily used) for downloading whole albums, it still contributes the greatest share of piracy in terms of tracks, namely 72%. The following table displays the most recent estimates by IFPI on the contribution of each of the main piracy areas to overall tracks downloaded globally.

Table 5 Split of music piracy by piracy area (in terms of tracks)

Piracy form	Percentage of overall tracks downloaded
Stream ripping	9%
BitTorrent	72%
Lockers	16%
MP3 sites	3%

Source: IFPI. Data still to be published, but was provided for purposes of this report and is used here with permission of IFPI. Note: 1) The data refers to the 12 months to June 2016. 2) The split excludes P2P activity outside BitTorrent, primarily from the Ares network which is popular in Latin America, and EMule which is popular in Europe. Since these only comprise 1-2% of total music piracy, however, their exclusion can only have marginally affected the above numbers. 3) China is not included in the above split because there is limited information on how exactly the market works. However, since it is the 14th largest music market globally, this should not have significantly affected the above numbers.

Using this information to scale up our above estimate of illegally downloaded tracks via BitTorrent networks, we estimate that there were **27.4 Billion illegally downloaded tracks across all forms of music piracy in 2015.**

In order to get from the total number of illegally downloaded songs to a total commercial value, we again need to multiply by the price of a relevant legal substitute. Unsurprisingly, experts disagree on what this legal substitute could be. On the one hand The American Assembly argues that legal streaming satisfies consumers' demand for cheap, convenient access to music in a similar way as pirated music does.[54] On the other hand, MusicWatch highlights that 'ownership' matters to pirates so that one would expect purchasing a song (digitally or physically) rather than streaming to be a closer substitute to pirating.[55] Because of such ambiguous evidence, we generated a weighted average price across all different forms of legal music consumption (CDs and other physical discs, digital permanent downloads, digital subscriptions and streaming), using sales volumes as weights. These should provide a reasonable proxy for consumers'

[52] MusicMetric (2012) Digital Music Index

[53] http://www.musicwatchinc.com/blog/bad-company-you-cant-deny/

[54] The American Assembly (2013) Copy Culture in the US & Germany

[55] http://www.musicwatchinc.com/blog/bad-company-you-cant-deny/

propensity to engage in the different possible forms of music consumption.[56] The sales volumes as well as the average prices of each music format are obtained from the RIAA 2015 Year-End Industry Shipment and Revenue Statistics.[57] The average price per track in the US is then $1.06.[58]

Multiplying this average price by our estimate of the total number of illegally downloaded tracks in 2015, we find the **value of pirated music in 2015 to be $29 Billion.**

As for movies, it would have been preferable to use global price data instead of US data. However, there are again two reasons why, in the absence of global data, the usage of our chosen US data appears to be a sensible alternative:

1. The US represents the largest market for recorded music in the world with physical and digital recorded music revenues in the US making up 36%[59] of the global market. Hence, any global average price would be dominated by US data, and, by extension, the US can be considered as the single most representative country of global figures.

2. We have performed a sensitivity check based on (less granular) individual country level data of the world's top five music markets by revenue.[60] If we construct a weighted average price of music (spanning digital downloads, physical purchases and streaming) across these five countries and substitute this for the US price in our calculation above, our final estimate of the value of digital music piracy goes down slightly to $25 Billion. This confirms the adequacy of the US data that we have used because it is very close to our original estimate, and the direction of deviation is as expected.[61]

Finally, it should be noted that our approach does not cover music piracy in the form of user uploaded content. A common example of this kind of piracy would be the situation where someone posts a video with infringing content, such as a song for which they don't own the copyright, on YouTube. Typically, this displaces views of other YouTube content, for example the original music video to the song. As this generates fairly low revenue, the damage caused by this type of piracy is likely to be limited. Nonetheless, it is a growing issue and should be an area of future research.

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[56] Behavioural information as we used to determine movie consumption patterns above would have been preferable. However, such information appeared to be unavailable for music.

[57] RIAA 2015 Year-End Industry Shipment and Revenue Statistics. In the case of streaming we had to combine the revenue figure from RIAA with the estimate of total streams from the 2015 Nielsen Music U.S. Report to derive a per "streaming equivalent track" price. (Streaming equivalent track is our translation from Nielsen's "streaming equivalent album" (where 1,500 streams is equivalent to 1 album.)

[58] Details on the calculation can be found in Table 15, Annex B.

[59] According to figures from the IFPI Global Music Report 2016.

[60] As the data was provided to us by IFPI on a confidential basis, it cannot be displayed here.

[61] The construction of average prices involved dividing revenues by sales volumes in each of the three mentioned categories and bringing in some additional data sources for stream volumes, since IFPI does not record these. Most of these data sources measure something slightly wider than the number of streams that would correspond to the IFPI revenue figures so that they represent overestimates. This means that the resulting prices are skewed downwards slightly so that we expect our final result to be slightly downward biased too.

4.4 Software

$24bn

We estimate that the commercial value of **digital piracy in software** in 2015 was $24 Billion.

4.4.1

In the following, we first give some background on software piracy, reporting research findings from the literature. We then use a "top-down" approach to come up with a value of software piracy.

4.4.2 Overview of research findings

Consumers spent $444 Billion on software around the globe in 2015.[62] And there appears to be a similar shift from physical to digital as has been observed in all media industries over the last decade. To give an example, while physical software sales in the U.S. declined by 13% between 2014 and 2015, global digital video game sales grew by 8%.[63]

Piracy in software has been increasing over the last decade. According to the Business Software Alliance (BSA) the commercial value of unlicensed software installed on computers worldwide rose from $40 Billion in 2006 to $52 Billion in 2015 (with a peak of $63 Billion in the period 2011-2013).[64] The rate of unlicensed software installation (as a percentage of total software installation) in 2015 was as high as 39%.[65]

More evidence for the prevalence of software piracy comes from the 2013 version of Kantar Media's Online Copyright Infringement Tracker prepared for the UK's Office of Communications (Ofcom).[66] According to the study, 20% of internet users in the UK aged 12 and above claim to have consumed pirated software at some point in their lives. 12% admitted to have done so in the past three months. Interestingly, 39% of users who had paid for any computer software in the past three months said they had previously accessed some of it for free. 22% even claimed to have accessed *all* of the products for free before purchasing them. It seems to be an analogue to the "Hear before you buy" motive in music piracy. This means that for some users pirated software is not a substitute for authorised software.

Nonetheless, as in the area of film and music, it is likely that for many users pirated software does constitute a substitute for authorised software and hence harms the software industry by displacing legal sales. Indeed, in 2010 BSA estimated that "reducing the piracy rate for PC software by 10 percentage points in four years would create $142

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62 The figure is the result of multiplying the size of the global IT industry ($3.8 trillion) by the share of software (12%), both of which are given by CompTIA (2016) IT Industry Outlook 2016 https://www.comptia.org/resources/it-industry-outlook-2016-final

63 CNBC (2016) "Digital gaming sales hit record $61 Billion in 2015: Report", published on 26 January 2016 http://www.cnbc.com/2016/01/26/digital-gaming-sales-hit-record-61-Billion-in-2015-report.html

64 BSA (2010) Eighth Annual BSA Global Software 2010 Piracy Study and BSA (2016) "Seizing Opportunity Through License Compliance" Global Software Survey, May 2016. Note that while the 2006 figure is in 2005 dollars, the 2013 figure is in 2013 dollars, and the 2015 figure in 2015 dollars.

65 BSA (2016) "Seizing Opportunity Through License Compliance" Global Software Survey, May 2016.

66 Kantar Media (2013) Online Copyright Infringement Tracker Annex 1 – Individual content types, Wave 4 (Covering period March – May 2013), prepared for Ofcom

Billion in new economic activity".[67] More than 80% of this activity would be direct benefits to the software industry. Moreover, BSA found that if piracy were to drop at a faster pace, the economic gains would be dramatically higher. The findings of McLennan and Le (2011), though of a more general nature, point in the same direction. Using software piracy data from BSA and IDC's Global Software Piracy Study 2006, they find that a 1% decrease in software piracy is associated with a 0.2% increase in GDP per capita growth.[68]

Besides harming the supply side by causing business losses due to displaced sales, pirated or counterfeit software also has substantial negative consequences on the demand side. When pirating software, and especially when downloading it from the Internet, users incur a high risk of catching malware such as viruses, Trojans[69] or keyloggers.[70] According to IDC (2013) the chance of encountering malware when using counterfeit software is 1/3. The resulting costs are immense. In March 2013 IDC estimated that during the year consumers would waste 1.5 Billion hours dealing with malware from counterfeit software; direct costs to enterprises would amount to $114 Billion.[71]

4.4.3 Estimating piracy in software

For data reasons (particularly the lack of transparency around software prices) our approach to estimating piracy in software differs from the bottom-up approach used for estimating piracy in film and music. This time our starting point is the commonly quoted BSA Global Software Survey, which contains piracy rates and commercial values of unlicensed software in all regions of the world. The difficulty of using these numbers, however, is that they capture all kinds of illicit software acquisition some of which do not fall into the category of digital piracy. One example is the use of physical copies of counterfeit software, which is already captured by the domestic and traded counterfeit and piracy figures in section 3 of this report. Hence we need to "backward engineer" the value of digital software piracy by multiplying the BSA estimates by the share of pirated software that comes from online sources. In the following, we will describe our approach in detail.

The regularly published BSA Global Software Survey quantifies the value of unlicensed software installed on PCs around the globe in a given year. The main inputs of the 2016 edition of the report[72] are a global survey of more than 20,000 computer users carried out by IDC, and a survey of 2,200 IT managers in 22 countries. The surveys are used to determine the volume and type of software installed on home and enterprise computers and PC users' attitudes towards intellectual property and illicit software acquisition.

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67 BSA (2010) Piracy Impact Study: The Economic Benefits of Reducing Software Piracy

68 McLennan P. G. and Q. V. Le (2011) "The Effects of Intellectual Property Rights Violations on Economic Growth", *Modern Economy,* Vol. 2, pp. 107-113

69 A Trojan is a malicious computer program that is often disguised as legitimate software. Misleading users about its true intent, it hacks into the computer and deletes, blocks, modifies or copies data. It can also be used by hackers for spying, money theft or use of the hacked computer's identity.

70 A Keylogger is a type of software or hardware that records the keys struck on a keyboard, typically without the user being aware of it. It can therefore be used to obtain sensible user data like passwords or PINs.

71 IDC (2013) "The Dangerous World of Counterfeit and Pirated Software", White Paper

72 BSA (2016) "Seizing Opportunity Through License Compliance" Global Software Survey, May 2016

Based on these figures, BSA finds a total worldwide rate of pirated software installation of 39%, corresponding to a value of $52 Billion. This number captures a broad range of software: from operating systems, security packages and business applications to consumer applications like personal finance. It also does not seek to distinguish between the different ways in which such software has been acquired, which means that its coverage is broader than the value of *digital* piracy, which is the specific focus of this chapter.

In order to transform the BSA estimate of total software piracy into a value of digital software piracy, we draw on insights from a 2013 IDC survey:[73] Based on the survey respondents' ranking of top 3 sources of pirated software, IDC estimates that 45% of pirated software comes from online sources such as P2P networks or DDL file sharing systems.[74] Applying this number to scale down the BSA figure we estimate the **value of digital piracy in software to be $24 Billion.**

[73] IDC's (2013) *Dangers of Counterfeit Software Survey* presented in IDC (2013) "The Dangerous World of Counterfeit and Pirated Software", White Paper

[74] DDL stands for "direct download". DDL systems differ from P2P systems in that one downloads the whole file from one server (instead of downloading little pieces from many different sources) and doesn't automatically become a distributer of the file oneself,

EXCURSUS: ESTIMATING DIGITAL PIRACY IN VIDEO GAMES

Another major and increasing area of digital piracy is video games. By way of an exploratory approach, we outline how its commercial value could be estimated in a similar fashion to how we proceeded with digital piracy in music and movies.

In short, such a bottom-up approach would require multiplying the number of illegal games downloads by an appropriate average price of games. The individual steps are outlined below.

1. One could start from the number of BitTorrent downloads, based on worldwide data on games downloads via BitTorrent networks.
2. The figure needs to be scaled up to a total number of illegal downloads, i.e. the number of illegal games downloads via all channels. Here one could draw on insights from Kantar Media's Online Copyright Infringement Tracker.[75] Based on a survey conducted during the period March-May 2013, the study finds that 11% of infringers use BitTorrent services to source pirated computer software. It seems justifiable to assume that this largely holds true for games too.[76] With the additional, conservative assumption that BitTorrent users would not engage in pirating games via any other channels, one can use these 11% to scale up the initial result on the number of BitTorrent downloads.
3. The average price of games in the US is $38.[77] In lack of better data, one could use this as a proxy for the global average price of games.
4. Multiplication of this average price by the quantity of illegally downloaded games yields a total value of digital piracy in games.

Depending on the availability of data, one could proceed in a similar way with piracy in mobile gaming.

4.5 Conclusion and discussion

The following table summarizes the results of our estimations of piracy in the areas movies, music and software.

[75] Kantar Media (2013) Online Copyright Infringement Tracker, Annex 1 – Individual content types, Wave 4 (Covering period March – May 2013), prepared for Ofcom

[76] The study does not separately list BitTorrent for games.

[77] This is the result of dividing the 2013 dollar sales figure of the US computer and video game software industry by the 2013 unit sales figure as recorded by ESA (2014) "Essential Facts about the computer and video game industry", http://www.theesa.com/wp-content/uploads/2014/10/ESA_EF_2014.pdf.

Table 6 Summary of estimates of digital piracy

Result	2015	2022 (forecast)
Estimate of digital piracy in film	$160 Billion	$289-644 Billion
Estimate of digital piracy in music	$29 Billion	$53-117 Billion
Estimate of digital piracy in software	$24 Billion	$42-95 Billion
Estimate of digital piracy in film, music and software	**$213 Billion**	**$384-$856 Billion**

Source: Frontier estimates based on latest data from industry sources (2015)

In summary, we estimate the value of digital piracy in music, movies and software in 2015 to be **$213 Billion**. We project that this value is likely to increase to **$384 - $856 Billion** by 2022. This projection is based on the following assumptions: either (i) that the share of piracy relative to counterfeiting and piracy as a whole remains stable over time; or (ii) that the share of piracy grows in line with projected growth in global IP traffic (The reader is referred to section 6.1 for a fuller discussion).

We consider our bottom-up approach as relatively robust. The TECXIPIO data gives us very reliable estimates of BitTorrent activities worldwide, and multiplication of the number of illegal downloads by a weighted average price is a straight forward and sensible approach to estimating the value of piracy.

Nonetheless, it is not clear how far online activity in places like China or Russia (that are two of the biggest for piracy) can be fully captured even by a BitTorrent-tracker. This suggests (as a first caveat to our approach) that the TECXIPIO figures and, by extension, our estimates may be slight underestimates of the true value of digital piracy.

Moreover, the shares of BitTorrent network activity compared to other forms of digital piracy can change quickly from year to year so that even the usage of the most recent available data (like the 2013 NetNames study) may not be sufficient for capturing the latest behavioural trends in digital piracy. From information from IFPI, we know that the popularity of BitTorrent may have declined a little since 2013. This means that we would have to scale up the TECXIPIO figures by even higher numbers than the NetNames (2013) study suggest to arrive at the total number of illegal movie downloads. Like with the first caveat, this means that our estimates may be slightly lower than the true value of digital piracy.

The third and most significant caveat to our approach is that we construct average prices based on US data. Naturally, global weighted average prices of movies, music and software would have been preferable – however, such estimates are impossible to obtain with the currently existing data. In several places, we have outlined why the US data that we have used is a reasonable proxy. However, it is possible that the results nonetheless differ slightly from the true value of digital piracy. It is not clear in which direction this effect works.

Weighing the above considerations, it seems possible that the commercial value of digital piracy in music, film and software is even higher than we have estimated. In addition, since we have not assessed piracy in a number of areas such as TV-series,

exclusive contents produced by OTT platforms (like Netflix), eBooks, mobile gaming or piracy through user uploaded content, it is most likely that the value of total digital piracy exceeds our estimates by a considerable amount.

5 QUADRANT 4: WIDER ECONOMIC COSTS

5.1 Introduction

As observed in section 2.1, counterfeiting and piracy impose private losses on owners of intellectual property, as well as wider social losses. Specifically, the 2008 OECD report acknowledged that counterfeiting and piracy "can have broader economy-wide effects on trade, foreign investment, employment, innovation, criminality and the environment…and with respect to governments, counterfeiting and piracy have direct effects on tax revenues and government expenditures."

The OECD's work acknowledged the likely significance of these costs. It was not, however, within the scope of their research to attempt to quantify these costs. The purpose of this section is therefore to extend the analysis initiated by the OECD by attempting to quantify these wider economic costs.

The first issue on which we focus is the question of economic growth. More specifically, we wish to examine to what extent an increase in the level of counterfeiting and piracy reduces economic growth. There are several *a priori* reasons that suggest that such illicit activities could reduce economic growth:

- The erosion of intellectual property rights weakens the incentives to innovate. This has a direct impact on well-being by reducing the range of products and services consumers can access, and, in the longer run, by affecting economic growth. The latter effect operates mainly through the links between innovation, technological progress and productivity.
- The substitution of activities that fall under formal frameworks of governance and regulation, by ones that are not subject to such control, can undermine economic growth. This is because of the close links that such "underground" activities have with various forms of criminality make this substitution (i.e. counterfeiting and piracy) a conduit of resources that support the expansion of these criminal activities. The substitution effect can also erode tax revenues and reduce employment, though the extent to which this is true depends on whether other sectors in the legitimate (taxable) economy expand (for example, if consumers reallocate spending to these sectors, of if labour displaced by counterfeiting or piracy in one sector is reallocated to another sector).

In the case of economic growth, the linkages between counterfeiting and piracy are not uncontested. It has been argued for instance, that while these activities may displace legitimate activities in some sectors, consumers may reallocate any savings they make from purchasing counterfeit, but cheaper, goods to other sectors. The argument has also been made that counterfeiting could enable poorer countries to have cheaper access to technology. Finally, the argument is made that the direction of causality flows from growth to counterfeiting and piracy: as countries become richer and have stronger institutions, they are able to enforce IP rights more effectively.

For these reasons, we employ an econometric methodology that examines, on balance, the effects of counterfeiting and piracy on growth, while controlling for the issue of causality and countervailing factors.

Beyond the effects on economic growth, we consider a range of other specific macro-economic effects: effects on employment, effects of tax, and effects on foreign direct investment. We also consider wider social costs, including the effects of crime and health.

5.2 Econometric analysis of impacts on economic growth

In this section we seek to estimate the impact of counterfeiting and piracy on growth rates by testing the relationship between these variables at the country level, and assessing whether higher levels of this activity are associated with reduced growth. This is a 'top-down' approach, as any observed relationship will capture the whole range of different growth impacts, as well any second-round impacts or counteracting effects, although it will not provide detail on the operation of specific impacts. We begin by considering the appropriate indicators for modelling cross-country variation in counterfeiting and piracy, and then measure the impact of the selected indicator with economic growth.

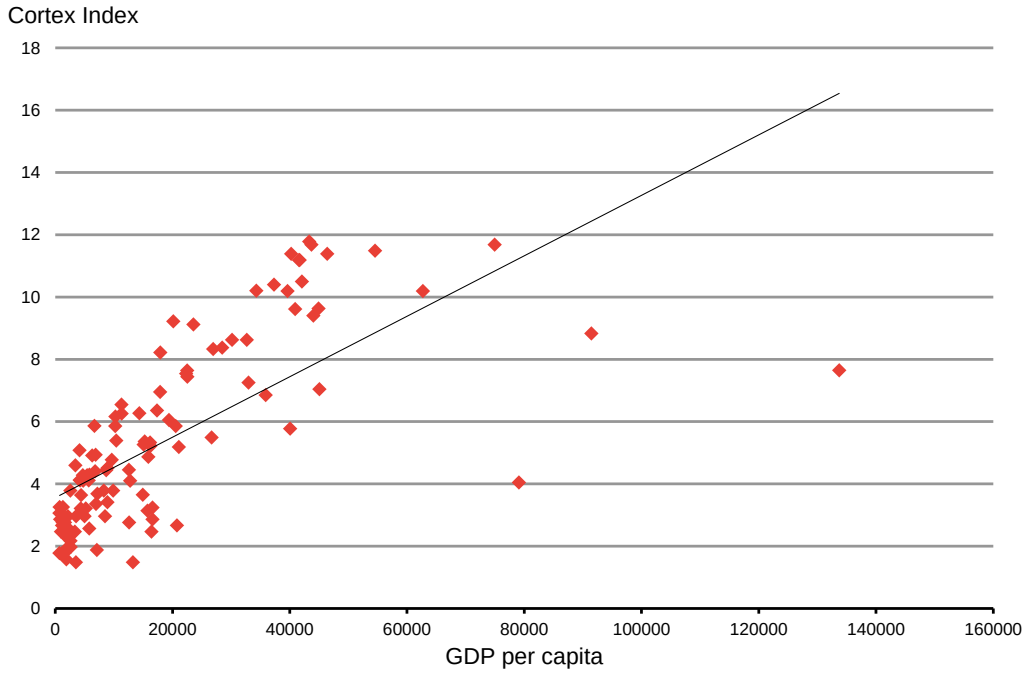
5.2.1 Methodology and approach

Our starting point is the literature that links the enforcement of Intellectual Property Rights (IPRs) to economic performance. One measure of the strength of IPR enforcement is the Cortez Patent Index analysed by Lesser.[78]

Lesser establishes that a variety of scorecard measures of IPR regimes all carry the same information and that it makes little difference which measure is used. His research shows a strong positive relationship between GDP levels and IPR enforcement, as shown in the scatterplot below. Focusing on countries with GDP per capita less than $60,000, a $1000 increase in per capita income is associated with a 0.18 increase in Cortez Index, and GDP explains 78% of the variation in the Cortez Index.

[78] W. Lesser, Measuring Intellectual Property 'Strength' and Effects: An Assessment of Patent Scoring Systems and Causality, 4 J. Bus.Entrepreneurship & L. Iss. 2 (2011)
Available at: http://digitalcommons.pepperdine.edu/jbel/vol4/iss2/4

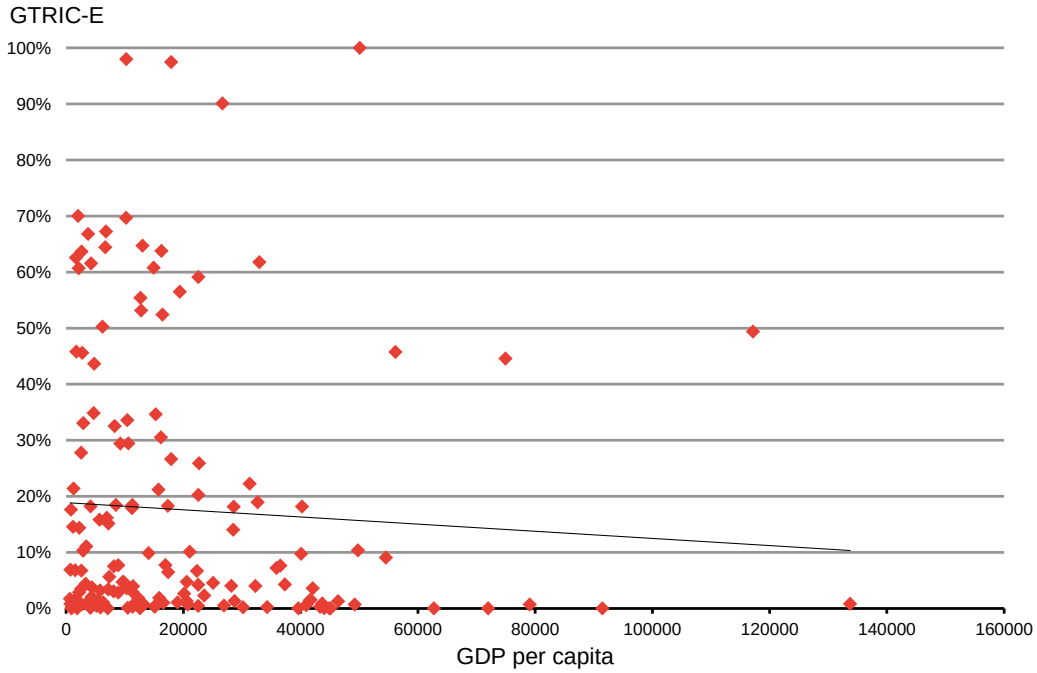
Figure 2. Cortez Index and GDP correlation



Source: Frontier analysis of Lesser (2009) and World Bank data

We then consider whether a similar relationship may hold for indices of counterfeiting as developed by the OECD, such as GTRIC-E. But the relationship between GDP and GTRIC-E is weak. This is apparent from the scatterplot below. In fact, GDP explains only 0.37% of the variation in GTRIC-E. The trend line indicates a slight negative relationship between the two but this effect is not statistically significant.

Figure 3. GTRIC-E and GDP correlation



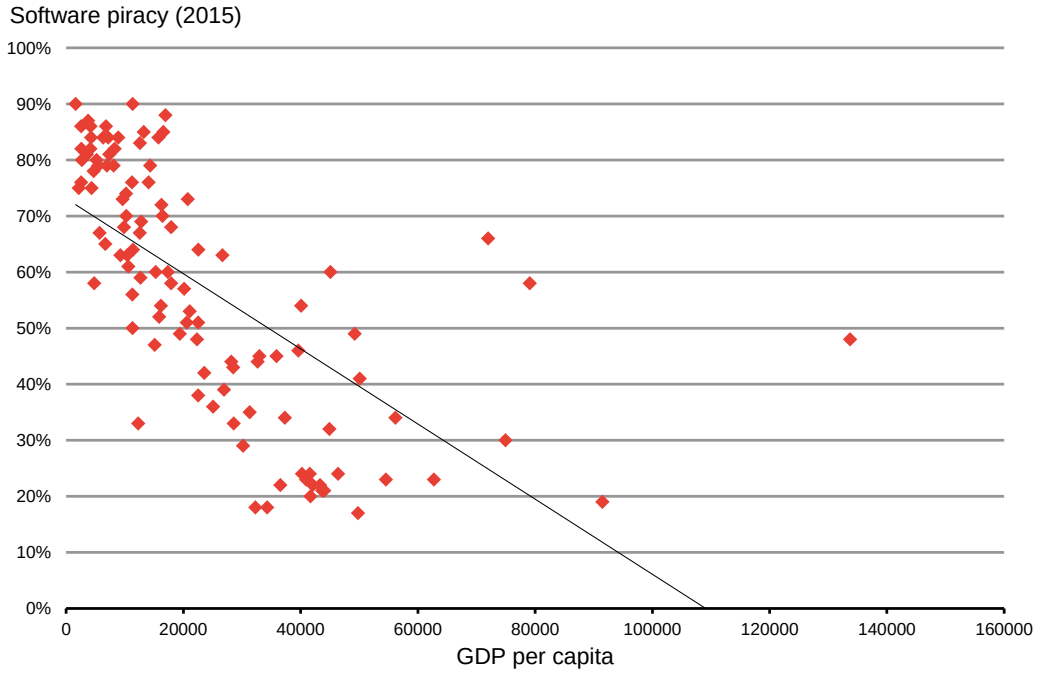
Source: Frontier analysis of OECD and World Bank data

In our view this reflects the particularities of the GTRIC indices, which were developed to estimate an overall global value for piracy and counterfeiting. The work was less concerned with capturing in detail country-by-country variations. Indeed, data and methodological limitations precluded this possibility.

We therefore consider an alternative measure to proxy for country-by-country variation in counterfeiting and piracy. BSA Software Alliance estimates the prevalence of software piracy by country. This is done by comparing legitimate sales of software with the estimated amount of software use by country. The "software load" estimates are based on a global survey of software users and IT managers, assessing the number of computers and amount of software installed by country. This uniform approach applied across countries should give more consistent estimates, with less scope for the measurement error issues than arise in relation to GTRIC.

Software piracy is closely correlated with GDP per capita, as shown in Exhibit 3, below. GDP per capita explains 42% of the variation in piracy rates (68% if countries with GDP in excess of £60,000 per capita are excluded). Software piracy is highly correlated with other intellectual property right enforcement measures, for example explaining 80% of variation in the Cortez index. It is therefore a reasonable proxy for wider IPR infringement including counterfeiting.

Figure 4. Piracy and GDP correlation



Source: Frontier analysis of BSA and World Bank data

Our approach therefore is to estimate the impact of counterfeiting and piracy on growth rates. Specifically, we use the average growth rate from 2009 to 2015. In keeping with the economic theory of growth we control for the level of GDP (log GDP as at 2009), to allow for the possibility that poorer countries grow quicker than richer countries and eventually catch up. We also want to control for various other institutional and policy factors that affect growth, and we do this by incorporating a variable representing the World Bank Ease of Doing Business index.[79] We then explore the effect on economic growth of a percentage point change in piracy rate between 2009 and 2015.[80]

5.2.2 Results

We report the results in the table below. The column headings refer to different specifications of the growth equation that we estimated – one in which we measure the effects of piracy in isolation, and another in which we measure the effects in combination with the Ease of Doing Business index.

[79] For more information on World Bank Ease of Doing Business index, please refer to: http://www.doingbusiness.org/

[80] Although the selected indicator relates specifically to piracy, due to the high correlation of piracy with counterfeiting and other intellectual property right infringement, it is reasonable to infer that these impacts reflect a wider set of activities, rather than piracy in isolation. However, it is not possible to conclude on the relative impacts of different types of infringing activity.

Table 7 Regression of GDP growth on change in piracy

	(1) Piracy	(2) Piracy, EDB
Log GDP	-0.007***	-0.011***
Change in piracy	-0.329***	-0.212***
Change in EDB		0.001***
Constant	0.072***	0.071***
N	109	107
R-squared	0.25	0.32

Source: Frontier analysis of World Bank and BSA data

In all cases, we see a negative impact of piracy on growth. This is consistent with the findings of McLennan and Le (2011).[81] Specific points note are:

- A 1 percentage point increase in piracy reduces growth by between 0.33 and 0.21 percentage points (e.g. from 2% to 1.7% or 1.8%). Applied to nominal GDP forecasts for the OECD as a whole to 2017, **a one (1) percentage point reduction in piracy would be associated with an additional 34 to 54 Billion US dollars.**
- We continue to observe a negative effect of piracy on growth even when we control for the effects of other institutional factors that improve the business climate of a country.

Taken together, the results demonstrate that there are substantial payoffs in terms of economic growth opportunities from investing in actions that lower the incidence of counterfeiting and piracy. In particular, actions to curb counterfeiting and piracy carry their own weight in relation to broader institutional measures to improve the climate for business and investment in a country. Policy decisions and investments to reduce the incidence of counterfeiting and piracy can therefore be seen as valuable extension of broader reform measures that are taken to stimulate economic growth.

[81] Q. Le and P. McLennan, "The Effects of Intellectual Property Rights Violations on Economic Growth," Modern Economy, Vol. 2 No. 2, 2011, pp. 107-113.

5.3 Impacts on displaced economic activity, tax, employment and investment

In this section we consider the effects of international and domestic counterfeiting and piracy on the (i) displacement of economic activity (lost GDP), (ii) uncollected tax losses to government and (iii) displaced or lost employment. Since counterfeit and pirated products displace genuine products, and tax is unlikely to be earned on them, so government tax revenue is reduced. Employment involved in producing the genuine product will also be reduced. We model these impacts by combining (i) estimates of international and domestic counterfeit and pirated goods by country and product, (ii) assumptions on displacement at the product level, and (iii) tax and employment data at the country level.

This approach builds on the methodology developed in our 2009 study.[82] In the 2009 study, industry expert opinion was used to develop assumptions on displacement for specific sectors, and the tax and employment impacts modelled in close detail for UK and Mexico, and then extrapolated to other G20 countries.

Here we extend the 2009 displacement assumptions to cover a much wider range of goods (each 'Comtrade' HS code) and we use the GTRIC estimates of counterfeit prevalence for each country, rather than extrapolate from UK and Mexico. But due to the large number of countries analysed, and their different structures of tax systems, it is not feasible to analyse a country's tax impact in detail. Instead, we use some of the relativities of sales, income, corporation tax and benefits identified in the 2009 study, and apply these to the displacement estimates to derive full at the country level.

This analysis estimates the total amount of genuine economic activity displaced by counterfeit activity[83], and the direct impact on taxes and employment. These impacts are 'gross' in the sense that counterfeit production will also employ labour and may pay some taxes (e.g. where taxed inputs are used). There may also be inter-country effects if, say, counterfeit exports from country A displace genuine exports from country B. While it is difficult to arrive at such net effects, the size of displacement effects indicates the potential distortions arising from counterfeiting, with resources allocated away from efficient and integrated supply chains and into illicit modes of production.

5.3.1 Displacement of genuine products

For this model, we firstly need to estimate the displacement of genuine products. The amount of genuine activity displaced by counterfeits depends on the proportion of consumers that would purchase the genuine product if the counterfeit was unavailable. This is further split-out by whether consumers are knowingly or unknowingly purchasing the counterfeit products, as the displacement propensity may vary for these two groups. Those who knowingly purchase counterfeit products are unlikely to have purchased the

[82] http://www.iccwbo.org/Data/Documents/Bascap/Why-enforce/Deterioration-of-tax-base/Impact-of-Counterfeiting-on-Governments-and-Consumers-Exec-Summary/

[83] This will include physical piracy to the extent to which extent that physical pirated goods appear in the Comtrade data, but not capture displacement due to online piracy.

genuine equivalents, typically purchasing the counterfeit because it has characteristics of the genuine product but is substantially cheaper. By contrast those who were deceived into purchasing the product would be more likely to have purchased the genuine product if the counterfeit was unavailable, so for this group there is a relatively higher propensity for counterfeits to displace genuine products.

The 2009 study developed the assumptions on displacement on the basis of existing national and international research, questionnaire evidence from firms in the sectors concerned, and primary consumer survey evidence commissioned by BASCAP.

The following displacement rates were assumed (same for both UK and Mexico):

Table 8 Displacement rates used in 2009 study

Product	Displacement rate
Leather clothes	57%
Luggage, handbags	57%
Footwear	51%
Perfume	51%
Watches	46%
Jewellery	57%
Other	51%
Food and beverages	95%
Pharmaceuticals	100%
Software	86%

Source: Frontier Economics / BASCAP 2009 study

Note that displacement is generally lower for luxury goods or more 'discretionary' items, for which there is greater scope of undercutting prices of genuine products and boosting sales. By contrast, for more 'commodified' products such as food, drink or pharmaceuticals, it is more likely that the counterfeit does not have the characteristics of the genuine product. For example, counterfeit medicine is unlikely to be as effective as genuine. As a result, displacement rates are higher for these goods.

Based on the above assumptions derived in detail for the 2009 study, we have made the assumptions for each HS code appearing in the Comtrade data, ranging between displacement of 50% and 100%. The displacement rate is assumed to be lowest for goods such as clothing, equipment and perfumes and highest for pharmaceuticals, chemicals and foodstuffs.

Table 9 Displacement assumptions by product category

Product group	HS codes	Displacement assumption
Tobacco	24	50%
Perfume	33	50%
Special fabrics	58	50%
Clothing	61-67	50%
Precious stones and coins	71	50%
Electrical equipment	85	50%
Manufactured equipment and articles	90-96	50%
Art and antiques	97	50%
Raw textiles and leathers	41-43, 50-53	55%
Carpets and knitted fabrics	57,60	60%
Stone, glass, ceramics	68-70	80%
Vehicles	86-89	80%
Foodstuffs	1-23	95%
Rubbers and plastics	34-40	95%
Wood and paper products	44-49	95%
Man-made fibres	54-59	95%
Metal and mineral products	72-83	95%
Chemical and pharmaceutical products	25-32	100%

Source: Extension of Frontier assumptions used in 2009 study

The total amount of activity displaced is a product of the displacement rate, the counterfeiting rate and total consumption. We can therefore estimate total displacement by using current data on counterfeiting rate (from GTRIC), total consumption (ISIC D) and the assumed displacement rates. This suggests that in 2013, between $470bn and $597bn of genuine activity was displaced by counterfeiting (the range depends on assumptions concerning the level of domestic counterfeiting).

Table 10 Displaced activity due to counterfeiting

Type of counterfeiting	Low domestic scenario	High domestic scenario
International	$313bn	$313bn
Domestic	$157bn	$283bn
Total	**$470bn**	**$597bn**

Source: Frontier analysis of OECD and Comtrade data

5.3.2 Tax and employment impact

The amount of displaced activity feeds through into a number of different impacts – lost business tax (sales tax, corporation tax, excise duty), lost income tax and increased benefit payments to unemployed as a result of displacement. In the 2009 study, these

impacts were modelled in close detail by sector for the UK and Mexico. The most important category of financial impact was in sales tax – representing between 70% and 90% of losses, depending on sector. For the UK, sales tax represented 81% of the overall economic cost, whereas for Mexico it represented 92%.

We calculate sales tax impacts simply by multiplying the amount of displaced activity by the sales tax rate in the consuming country. This suggests that the reduction in sales tax across countries as a result of displacement effects is in the range of $70bn to $89bn per annum.

Table 11 Impact on sales tax revenue as a result of displacement due to counterfeiting

Type of counterfeiting	High domestic scenario	Low domestic scenario
International	$45bn	$45bn
Domestic	$24bn	$44bn
Total	**$70bn**	**$89bn**

Source: Frontier analysis of OECD and Comtrade data

The impacts through other tax channels are much more complicated, as they would depend on each country's tax structure and would need to be modelled on a country-by-country basis.

Given the relativities between sales tax and other tax impacts estimated previously for UK and Mexico, there could be between $8bn and $22bn global reduction in other taxes as a result of displacement effects.[84]

Employment impacts are calculated by dividing through displaced output by GDP per worker, which is calculated at country level from the World Bank WDI dataset and World Economic Outlook data.[85][86] This would suggest gross employment losses in the range of 18m and 23m. Of these, some would quickly find other employment, and others (around 1/3) would be long-term unemployed. [87] In order to translate this into a net employment loss, we need to consider the proportion of displaced workers that would subsequently find other employment, which we assume to be 2/3 of the long-term unemployed. This would give net job losses in the range of 2.0m to 2.6m.

[84] Range depends on level of domestic counterfeiting and assumed ratio of non-sales to sales tax (20:80 or 10:90).

[85] WEO data reports GDP per worker. This is translated into an industry/manufacturing measure using industry share of employment and industry share of GDP reported in WDI. Although it would be desirable to measure lost employment at country-product level, consistent data on GDP per worker by product and country are not available.

[86] An implicit assumption is that the counterfeit and genuine products originate from the same country. In fact there may be considerable displacement effects, e.g. if domestic counterfeits in country A displace imports from country B. Such effects are beyond the scope of this study.

[87] This is calculated using country-level breakdown of unemployment by duration reported by the ILO. Across countries around one third of unemployed are long-term (unemployed for a year or more). We assume of that proportion of long term eventually unemployed finding jobs is 2/3, leaving 1/3 of the long term unemployed without jobs. Hence, net job losses are given by 18m*1/3*1/3 = 2m and 23m*1/3*1/3 = 2.6m

5.3.3 Foreign Direct Investment impact

Lenient IPR enforcement in a country is likely to make firms in IPR-sensitive sectors less eager to invest there. This is because of the vulnerability of proprietary processes to theft, and/ or that infringing products are more likley to displace sales of genuine products. By contrast, enforcing intellectual property rights can stimulate FDI, and through that channel improve welfare in the host country. [88]

A study[89] by the NBER quantifies the impact of IPR enforcement on FDI and through this on exports. The study found that stricter enforcement of IPRs increased exports by up to 20%. For the purposes of our estimation, we take into account the fact that other studies have found that the effects of IPRs on FDI and economic performance may be uneven across countries[90]. Hence, we adopt a more conservative approach regarding the effects of IPRs on FDI and exports. We assume that a country's exports will be 5% lower as a result of lax IPR enforcement, as it is less attractive to locate production of IPR-intensive goods in these countries.

We estimate these FDI impacts by identifying IPR-sensitive sectors and countries with high rates of counterfeiting. We draw on evidence from the European Commission[91] in identifying the IPR-sensitive sectors, which mainly relate to equipment manufacture, pharmaceuticals, chemicals and metallurgy. We define as low IPR countries those with a GTRIC-E score greater than 0.5.

On this basis, the total reduction in FDI is estimated as $111bn, calculated by applying a 5% reduction to Comtrade exports in the relevant sectors and countries. This is associated with lost sales tax of $18bn.

There are also likely to be wider tax impacts (e.g. on corporation tax and excise tax), but these vary according to a country's specific tax regime. In addition, there are likely to be further dynamic impacts on the economy, as there is less exposure to innovation and R&D spill overs that would be brought by FDI.

5.4 Other social impacts

In addition to the effects reported above, various other negative social impacts of counterfeiting and piracy have been documented. The United Nations, for example, finds that these activities have recognised links to organised crime, and have negative

[88] See HitoshinTanaka and Tatsuto Iwaisako (2014), "Intellectual property rights and Foreign Direct Investment: A Welfare analysis", in European Economic Review, Vol. 67, pp 107-124

[89] Intellectual Property Rights, Imitation and Foreign Direct Investment: Theory and Evidence, Lee Branstetter, Raymond Fisman, C. Fritz Foley and Kamal Saggi, Working Paper 13033, National Bureau of Economic Research , April 2007

[90] See notably Mila Kascheeva (2013), "The role of foreign direct investment in the relation between intellectual property and growth", Oxford Economic Papers, Vol. 65 (3):pp 699-720

[91] http://ec.europa.eu/internal_market/intellectual-property/docs/joint-report-epo-ohim-final-version_en.pdf

impacts on health, the environment, and labour conditions.[92] There are also reported links between these activities and terrorism. [93]

The dollar value of these negative impacts is difficult to quantify. We report one attempt at quantification relating to criminality. For other areas, such as health, we present evidence drawn from qualitative assessments and case studies.

5.4.1 Crime

Counterfeiting and piracy are criminal activities in and of themselves. But they also support the further development of criminality by providing crime organisations with funds to support criminal activities more generally. Socials costs reflect increases in the impact of criminality brought about by an increase in counterfeiting. The impacts include the value of lost lives, the costs incurred in anticipation of crime, and the physical and emotional consequences of crime. Estimating these costs require data on how far counterfeiting increases criminality, and the dollar value of the impact of crime.

The 2009 study developed an estimate of the social costs of crime due to counterfeiting by assuming a 1% increase in the crime rate due to counterfeiting, and applying this to other estimates quantifying the value of the cost of crime. Separate valuations were used for the UK and Mexico, [94] and then extrapolated to other countries. Applying this approach, global impacts due to increased criminality are estimated to be in the region of $60bn per annum.

We caution that these results are preliminary. An avenue for further research would be to estimate the impact of counterfeiting on specific forms of criminality, but this would be a daunting empirical task and it may be difficult generalising such results to other countries.

5.4.2 Health impacts

The consumption of counterfeit and pirated goods can have negative effects on health because the products are not subject to the regulatory standards and production norms that govern legitimate goods and services. The problem applies to a range of products. To give an example, it seems likely that a large proportion of deaths through alcohol poisoning in Russia (17,302 in 2012) is caused by counterfeit products, which account for 30-40% of alcoholic beverages in the country.[95]

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[92] United Nations Office on Drugs and Crime, The Illicit Trafficking of Counterfeit Goods and Transnational Organised Crime.

[93] Gregory F. Treverton, Carl Matthies, Karla J. Cunningham, Jeremiah Goulka, Greg Ridgeway, Anny Wong, (2009) Film Piracy, Organised Crime, and Terrorism, Rand Corporation.

[94] Specifically, we used an estimate provided by the UK Home Office (see Home Office Research Study 217, "The economic and social costs of crime"), which valued the social cost of crime at Euros 80 Billion for the period 1999-2000. This estimate was then revalued to account for a drop in the crime rate since the estimation period, and an increase in prices. For Mexico, the starting point was estimates of crime found in "The Social Costs of Crime in Mexico City and Suburban areas" by R Villoro, George Washington University, G Teruel Universidad Iberoamericana, Estudios Economicos 2003.

[95] Kotelnikova Z. (2014) „Consumption of counterfeit Alcohol in Contemporary Russia: The Role of Cultural and Structural Factors", Basic Research Program, Working Papers, National Research University, Higher School of Economics, https://www.hse.ru/data/2014/08/06/1314159630/47SOC2014.pdf and Bazenkova A. (2015) "Russian

The highest costs, however, likely arise in relation to counterfeit pharmaceuticals and medicine. The WHO estimates that in some developing countries counterfeits comprise between 10-30% of the market value of drug sales.[96] In developed countries the share is much lower (about 1%), but even here the issue seems to be growing as "drug shortages, a long and convoluted supply chain, and Internet pharmacies" facilitate access for counterfeits into the market.[97] The total number of deaths related to counterfeit drugs is hard to determine[98], but Interpol's estimate of more than a million per year gives an idea of the order of magnitude.[99]

Particularly great harm seems to come from fake malaria drugs. A recent study found that in 2013 counterfeit, substandard or degraded anti-malarials contributed to the deaths of more than 120,000 children below 5 in sub-Saharan Africa.[100] The majority of counterfeit drugs comes from China and India,[101] and many traders choose Africa as destination because of relatively open borders and "completely disparate pharmaceutical distribution systems".[102]

Counterfeit pharmaceuticals may contain incorrect dosages of active ingredients, the wrong active ingredient, or no active ingredient at all.[103] In some cases they may have no effect whatsoever, but in other cases they may contain fatal amounts of active ingredients or other toxic chemicals.

Beyond the direct health effects arising from the consumption of counterfeit and pirated foodstuffs or medicines, there will also be substantial indirect effects. These include: loss of household livelihoods when principal wage earners are affected, reduced labour productivity, loss of confidence in health systems, and increased work load for health workers[104]

Government Cracks Down on Counterfeit Alcohol", *The Moscow Times* from 7 October 2015, https://themoscowtimes.com/articles/russian-government-cracks-down-on-counterfeit-alcohol-50131

96 UNODC (2010) „The Globalization of Crime – A Transnational Organized Crime Threat Assessment", http://www.unodc.org/documents/data-and-analysis/tocta/TOCTA_Report_2010_low_res.pdf

97 e.g. Blackstone E. A., Fuhr, J. P and Pociask S. (2014) "The Health and Economic Effects of Counterfeit Drugs", *American Health & Drug Benefits, Vol. 7, No. 4, pp. 216-224,* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4105729/

98 because it is difficult to know with certainty whether it was in fact a fake drug that killed the patient and not, for example, the fact that a good quality drug had been given too late.

99 Natalie Southwick (2013) 'Counterfeit drugs kill 1mn people annually – Interpol!', *Insight Crime* from 24 October 2013, http://www.insightcrime.org/news-briefs/counterfeit-drugs-kill-1-million-annually-interpol

100 Nayyar G. M. L., Breman J. G. and Herrington J. (2015) "The Global Pandemic of Falsified Medicines: Laboratory and Field Innovations and Policy Perspectives", *The American Journal of Tropical Medicine and Hygiene* 15-0221 http://www.ajtmh.org/content/early/2015/04/16/ajtmh.15-0221.full.pdf+html

101 UNODC (2013) „Transnational Organized Crime in West Africa: A Threat Assessment", http://www.unodc.org/documents/data-and-analysis/tocta/West_Africa_TOCTA_2013_EN.pdf, pp. 40-41

102 ibid., p. 43

103 WHO (2016) "Substandard, spurious, falsely labelled, falsified and counterfeit (SSFFC) medical products", Fact sheet, http://www.who.int/mediacentre/factsheets/fs275/en/

104 Robles Y. R., Casauay, J. F. and Bulatao B. P. (2016), "Addressing the Barriers to Effective Monitoring, Reporting and Containment of Spurious/Substandard/Falsely-labelled/Falsified/Counterfeit Medical Products through Sustainable Multi-stakeholder Collaboration and Community/Consumer-based Interventions", A report prepared for the Medicines Transparency Alliance, Philippines, http://www.who.int/medicines/areas/coordination/SSFFC_Report.pdf

5.5 Conclusion

There are substantial wider economic and social costs stemming from counterfeiting and piracy. Indeed, our estimates for displacement effects, employment effects, supressed FDI and crime probably understate the extent of these costs. This is because these estimates do not capture the effects of digital piracy.

Our econometric analysis of the link between piracy and GDP establishes a link between illicit activity and dampened growth, consistent with other empirical studies in this area. Erosion of intellectual property rights is associated with poorer standards of governance and transparency, reducing incentives to invest or innovate, impacting on the long-term growth path of a country. The displacement of genuine activity by illicit activity is also likely to reduce efficiency, as the 'underground' economy is likely to have more irregular supply chains that do not optimally allocate resources. The diversion from genuine to criminal activity reduces government tax revenues and may also have serious consumer impacts due to regulatory non-compliance.

We have modelled a number of these wider social costs in detail using data at the country and product level. The summary estimates of the wider social costs of counterfeiting are shown below. The 2022 forecast is developed by applying projected growth in counterfeiting to the 2013 figures.

Table 12 Summary of estimates of wider impacts of international and domestic counterfeiting

Result	2013	2022 (forecast)
Estimated Displacement of economic activity	$470-$597 Billion	$980-$1244 Billion
Estimated FDI impact	$111 Billion	$231 Billion
Estimated tax loss	$96-$130 Billion	$199-$270 Billion
Estimated costs of crime due to counterfeiting	$60 Billion	$125 Billion
Estimated employment loss (gross)	18-23 million	38-49 million
Estimated employment loss (net)	2-2.6 million	4.2-5.4 million
Estimated value of lost growth (OECD region 2017)	$30-54 Billion	

Source: Frontier estimates

6 CONCLUSIONS

In this section, we project the value of counterfeiting and piracy forward, and summarise our results across the four quadrants.

6.1 Projections of the future incidence of counterfeiting and piracy

We project the estimates forward to 2022 to show how the scale of counterfeiting and piracy may change over time.

$991bn

We forecast that the value of international trade in counterfeit goods could reach $991 Billion by 2022.

First, we project forward the OECD/EUIPO's estimates of international trade in counterfeit and pirated goods to 2022. We forecast an average annual growth rate in trade of counterfeit and pirated goods of 9%.

This projection is estimated using a proxy for growth in future trade volumes. We draw on the World Trade Organisation's estimates of the annual growth rate of global merchandise import volumes, including forecasts to 2017. To forecast beyond 2017, we use the average actual and forecast growth rate as appropriate for 2012-17.

In addition, to account for the growth in counterfeiting and piracy, we use the average annual growth rate in the ratio of customs seizures to real imports in the EU and USA. These grew by 12% on average over 2005-14. Given that some of the growth in the ratio may result from stricter policy and enforcement (leading to an increase in seizures that in the past may entered unchecked), we assume that only half of this growth is the result of increased counterfeiting and piracy.

Using our estimate of the future growth rate of trade in counterfeit and pirated goods, we forecast that the value of trade in counterfeit and pirated goods could reach **$991 Billion** by 2022.

We carry out a similar exercise to illustrate how the size of domestic production and consumption of counterfeit and pirated goods may change over time, projecting our 2013 estimates forward. We forecast an average annual growth rate in domestic production and consumption of counterfeits of 9%.

$524-959bn

We forecast that the value of domestically produced and consumed counterfeit goods could range from $524 - $959 Billion by 2022.

This is estimated by extrapolating from

recent and forecast global GDP growth, as reported by the World Trade Organisation, to estimate annual GDP growth of 2.6% on average. Additionally, we account for growth in counterfeiting and piracy in the same way as in our projections of future trade in counterfeit and pirated goods.

Using this approach, we forecast that the value of domestically produced and consumed counterfeit and pirated goods could range from **$524 - $959 Billion** by 2022. This is a conservative approach to forecasting growth in counterfeiting and piracy. Comparing our preferred estimates of domestic counterfeiting and piracy from 2011-13 suggests an observed annual growth rate of 14%, although some of this change over time could be the result of changes to enforcement policy, or measurement error.

Following our methodology in the previous study, we use two different approaches to project digital piracy into the future.

$384-856bn

We forecast that the value of digital piracy in movies, music and software could range from $384 -$856 Billion by 2022.

- **The first approach assumes that all forms of digital piracy will maintain their respective share of total counterfeiting and piracy over time.** Our findings for 2015 suggest that the ratio of digital piracy to the value of counterfeit and pirated goods calculated in quadrants 1 and 2 lies between 0.20 and 0.25. If this ratio stays the same until 2022, the value of digital piracy will be approximately $384 Billion in 2022, according to our projections for quadrants 1 and 2. Proceeding in the same way on a disaggregated level, digital piracy in film will reach approximately $289 Billion, digital piracy in music $53 Billion and digital piracy in software $42 Billion in 2022. This approach is rather conservative because it does not take into account that internet usage in general and digital media consumption in particular are likely to grow faster over the next couple of years than the non-digital components of the market – as they have done in the past. Giving an example for media, the digital share of total media spending increased from 25.1% in 2008 to 40.1% in 2013 and is projected to rise to 50.4% in 2018[105]. It is likely that this could carry through to the share of digital piracy in total counterfeiting and piracy.
- **The second approach assumes that digital piracy grows proportionally to global IP traffic.** In a comprehensive study[106] Cisco projects global IP traffic to grow at a compound annual growth rate of 22% between 2015 and 2020. If piracy grows at the same speed as IP traffic and if the growth rate stays the same until 2022, all else being equal, the value of digital piracy is expected to reach $856 Billion in 2022 – comprising $644 from digital piracy in film, $117 from digital piracy in music and $95 from digital piracy in software. This approach is supported by one of the headline

[105] McKinsey Global Media Report 2014

[106] Cisco Visual Networking Index: Forecast and Methodology, 2015-2020

results of the NetNames study cited above: 'Internet usage continues to grow at a rapid pace; and with it, so does internet-based infringement.'[107]

Combining these two approaches, we forecast that the value of digital piracy in movies, music and software could reach from $384 - $856 Billion by 2022.

6.2 Projection of wider social and economic costs

As reported in section 5.5, we project changes in wider economic and social costs by applying projected growth in counterfeiting figures to the existing (2013) estimates, and assuming that the costs grow in line with counterfeiting. Based on that approach, we find that:

- Estimated impacts on lost Foreign Direct Investments are $231 Billion
- Estimated tax losses are $199 to $270 Billion
- Estimated costs of crime are $125 Billion

6.3 Summary of results

The analysis presented in this report underscores the magnitude of the policy problem posed by counterfeiting and piracy. Counterfeiting and piracy activities are broad in scope and large in value, and are growing. Using the more robust methodology developed by the OECD, and applying this to more recent data, we find that in 2013, the economic value of counterfeit and pirated products is estimated at between $0.9 Trillion and $1.1 Trillion. Our projections for 2022 show an increase to between $1.9 Trillion to 2.81 Trillion.

Comparing the findings

Comparisons between this report and the one we published in 2011 need to be handled with care because of refinements made to the OECD's methodology.

Nonetheless, it is worthy of a review. In our previous report we projected that the value of counterfeiting and piracy activities would be between $1.2 and 1.8 Trillion in 2015. On the basis of the data and approach followed in this report, we adjusted our base data figures from 2013 to create a 2015-year comparison, and we estimate that in 2015, counterfeiting and piracy stood at between $1.1 Trillion and $1.6 Trillion.

[107] NetNames (2013) „Sizing the piracy universe"

This report also takes a wider, global approach and a much deeper investigation into the broader social economic impacts and finds the losses flowing from these activities are significant. In generating our estimates, we consider four aspects of the economy that are negatively impacted by counterfeiting and piracy: (i) the magnitude of displaced economic activity, (ii) the impact on foreign direct investment, (iv) fiscal costs, and (iv) the economic costs of crime. We arrive at a figure of $737 Billion to $898 Billion for 2013, and projections of between $1.6 Trillion and $1.9 Trillion in 2022. These are non-insignificant costs to the global economy, nearly equal to the economic value of counterfeit and pirated products.

This report also implements recognised methodologies to estimate the foregone growth and development opportunities that arise from counterfeiting and piracy. We estimate that on a global basis, an increase in the incidence of counterfeiting and piracy reduces growth rates by between 0.21 and 0.33 percentage points. For the OECD region, this is worth between $30 and 54 Billion in 2015 alone in foregone growth opportunities.

We also estimate significant employment effects: an estimated 2 to 2.6 million jobs lost globally in 2013, and projected losses of 4.2 to 5.4 million by 2022.

Table 13 Summary of estimates of counterfeiting and piracy

Quadrant	Estimate	2013	2022 (forecast)
1	Total international trade in counterfeit goods	$461 Billion	$991 Billion
2	Total domestic production and consumption of counterfeit goods	$249 - $456Billion	$524 - $959 Billion
3	Digital piracy in film, music and software	$213Billion	$384-856Billion
	- Digital piracy in film	$160 Billion	$289-644 Billion
	- Digital piracy in music	$29 Billion	$53-117 Billion
	- Digital piracy in software	$24 Billion	$42-95 Billion
	Total value of counterfeit and pirated goods	**$923 Billion – 1.13 Trillion**	**$1.90 -$2.81 Trillion**
4	Wider economic and social costs		
	- Displacement of legitimate economic activity	$470-$597 Billion	$980-$1244 Billion
	- Estimated reduction in FDI	$111 Billion	$231 Billion
	- Estimated fiscal losses	$96-$130 Billion	$199-$270 Billion
	- Estimated costs of crime	$60 Billion	$125 Billion
	Total Wider economic and social costs	**$737 Billion-898 Billion**	**$1.54 - $1.87 Trillion**
	Estimated employment losses	**2-2.6 million**	**4.2-5.4 million**
	Foregone economic growth in OECD 2017	**$30 Billion to $54 Billion**	

Source: Frontier estimates based on OECD 2013 data on counterfeiting in international trade, and UN trade and GDP data to derive estimates for domestic production and consumption. Data for Piracy based on latest industry sources (2015).

It is important to continue to highlight the scale of the challenge posed by counterfeiting and piracy globally. We believe that a number of next steps are important, including the following.

- Further research into the prevalence of counterfeiting and piracy of physically traded goods that don't cross borders. Our analysis infers the prevalence of domestically produced and consumed counterfeits using the OECD/EUIPO analysis of internationally traded counterfeits. Further research would help ensure more precise estimates of the scale of domestic counterfeiting in future.
- The digital piracy landscape is changing rapidly. Further data collection and analysis to understand the scale of growing forms of digital piracy (e.g. gaming, copyright infringing user generated content, TV series) would help policymakers to better target digital piracy.

  Further analysis of and improvements to the customs seizures data that underlies the OECD/EUIPO analysis would be beneficial, for example in helping policymakers build up a picture of how prevalence of counterfeiting in different sectors and geographies varies year on year.

As noted at the beginning of this report, measuring the scale of counterfeiting and piracy not only helps us to understand the size of the problem, and the related social costs, but more importantly, it helps inform policymakers. With greater awareness of and appreciation for the enormous size of the problem and the significant impacts of counterfeiting and piracy on consumers, society, government and business, policymakers are better equipped to assign greater priority to fighting these crimes and allocating resources appropriately towards combating counterfeiting and piracy.

ANNEX A CONSTRUCTING AN AVERAGE PRICE OF MOVIES

Table 14 Movie watching behaviour and average prices in the US

Activity	Percentage	Percentage within movie consumption	Price per movie ($)
Watch TV live	34%	n/a	n/a
Play Games owned	12%	n/a	n/a
Subs. Stream TV/Movies	10%	26%	0.51
Watch TV on DVR	8%	n/a	n/a
Watch TV/Movies owned on Disc	7%	18%	4.72
Play Games Online Free	6%	n/a	n/a
Watch TV/Movies free on internet	5%	13%	0
Watch TV/Movies owned Digitally	4%	10%	4.72
Watch TV/Movies rented on disc	4%	10%	4.72
Watch TV on Cable VoD	4%	n/a	n/a
Watch Movies in Theatres	3%	14%	8.43
Play games rented	2%	n/a	n/a
Watch movies rented PP/VOD	1%	5%	0.51
Watch movies rented digitally (1 x Fee)	1%	5%	4.72
Weighted Average Price			**3.35**

Source : ***Percentages*** *calculated from Nielsen (2015) Home Entertainment Consumer Trends – Digital Transition Tracker Report, accessible at http://www.slideshare.net/JonathanBlumKurtz/home-entertaiment-consumer-trends; conversion to* ***Percentages within movie consumption*** *carried out by using the shares of TV and movies within Netflix consumption from Nielsen (2014)The Digital Consumer, accessible at http://www.slideshare.net/tinhanhvy/the-digital-consumer-report-2014-nielsen;* ***Price per Movie*** *(dollars) from http://money.cnn.com/2012/03/22/technology/streaming-movie-sales/ (average prices of 'physical' and 'online' movies in the US in 2012, which we have attributed to the above categories as appropriate) and http://www.the-numbers.com/market/ (average cinema ticket in the US in 2015); Percentages within movie consumption were taken as weights for calculating the weighted average price*

ANNEX B CONSTRUCTING AN AVERAGE PRICE OF MUSIC

Table 15 Music shipments, revenues and prices in the US

Format	Dollar value ($millions)	Units (million)	Tracks (million)	Average price per track ($)
Total physical retail units				
CD	1520.8	122.9	1229.0	1.24
CD Single	1.2	0.4	0.8	1.50
LP/EP	416.2	16.9	84.5	4.93
Vinyl Single	6.1	0.5	1.0	6.10
Music Video	73.2	3.3	33.0	2.22
DVD Audio	5.4	0.2	2.0	2.70
Digital Permanent Download				
Download Single	1226.9	1021	1021.0	1.20
Download Album	1090.7	109.4	1094.0	1.00
Kiosk	3.7	2.2	17.6	0.21
Music Video	6.4	3.2	3.2	2.00
Digital Subscription & Streaming				
Tracks	1604	317200	2114.7	0.76
Weighted Average Price				**1.06**

Source: ***Dollar values*** *and* ***units*** *(except for streamed tracks) are taken from RIAA 2015 Year-End Industry Shipment and Revenue Statistics; streamed track units are "streaming equivalent tracks" (where 150 streams are equivalent to one track) based on the streams figure given by the 2015 Nielsen Music U.S. Report; conversion to* ***Tracks*** *was done making assumptions on the number of tracks per medium;* ***Average prices per track*** *are calculated by dividing the Dollar value by the number of tracks; track numbers were taken as weights for calculating the weighted average price*

Note: We use stream equivalent tracks instead of streams because as people listen to the same stream multiple times, counting each of these as one track would decrease the average price below a reasonable level.

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